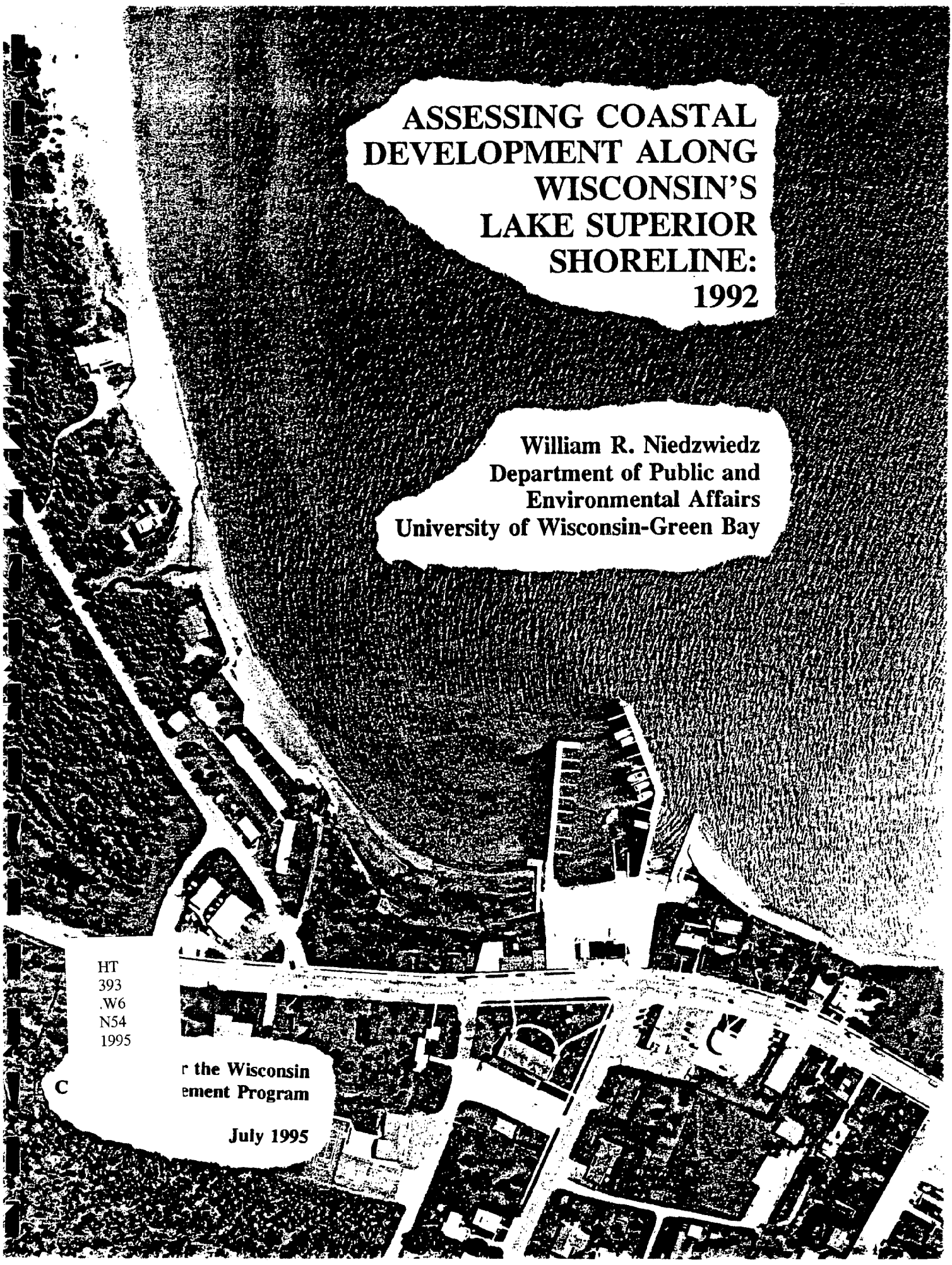

ASSESSING COASTAL DEVELOPMENT ALONG WISCONSIN'S LAKE SUPERIOR SHORELINE: 1992

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r the Wisconsin
ement Program

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THE WISCONSIN COASTAL MANAGEMENT PROGRAM, part of Wisconsin Department of Administration, and overseen by the **WISCONSIN COASTAL MANAGEMENT COUNCIL**, was established in 1978 to preserve, protect and manage the resources of the Lake Michigan and Lake Superior coastline for this and future generations.

The Project Team

This project required coordination and completion of several steps including map documentation, photo preparation, photo interpretation, digital area/linear measurement and data sheet preparation. The following students worked as a team to help complete this project.

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Assessing Coastal Development Along Wisconsin's Great Lakes Shoreline: 1978 - 1992

Coastal Management Program Contract No. 840005-501.15

INTRODUCTION

The Wisconsin Coastal Management Program mission includes developing an understanding of change along the state's Great Lakes shoreline. Such change, of course, can be natural or human-based. This study was undertaken to document natural and human-based development within the coastal zone of the state's Lake Michigan and Lake Superior shorelines. The Wisconsin legislature has defined coastal zone as land within 1,000' (304.8 meters) of the shoreline (Ordinary High Water Mark - OHWM).

Future coastal zone planning and risk assessment requirements defined the types of data to be collected. Assessment of risk to structures built in the coastal zone requires a temporal analysis of structural development and shoreline modification(s). Planning of the coastal zone requires, as well, determination of the natural resource base. This study utilized U.S. Army Corps of Engineers historic color aerial photographs taken in 1978 and 1992. Study of the Lake Michigan coastal zone utilizes available 1978 and 1992 photos. However, only 1992 photos were available for the Lake Superior segment of the study.

Readers should note that any references made below to 1978 photos refer only to the Lake Michigan portion of the coastal zone.

This report documents both the original and amended contract to assess natural and developmental change within the coastal zone of Wisconsin's Great Lakes shorelines. Although the original contracted work was interrupted to include elements of the amended contract, no attempt will be made in this report to keep separate original vs. amended objectives, procedures or results. Goals of the amended contract include and expand those of the original.

PROJECT GOALS

Planning and assessment of hazards within the coastal zone defined the goals of this study. Within the Lake Superior coastal zone, project goals included:

- Development of a land use database for 1992
- Development of a 1992 database of human modification of the shoreline
- Development of a database of built structures for 1992.

STUDY AREA

The project study area comprises the Wisconsin portion of the Lake Michigan and Lake Superior coastal zone (Figure 1). In 1982, the Wisconsin state legislature defined coastal zone as being that land within 1,000 feet (304.8 meters) of lake

Figure 1. Coastal Counties of Lake Michigan and Lake Superior

shoreline. Accordingly, the study area represents a 1,000' wide zone, the landward boundary of which is parallel to the coastline.

PROJECT METHODS

Aerial Photography

Using aerial photos to assess coastal development requires clear statement of goals, appropriate definition of coastal zone, meaningful classification scheme, appropriate historical and current aerial photos, appropriate interpretation procedure and method of documentation, and trained personnel.

Application of aerial photography to assess urban and natural resource features is documented well (Smith, 1968; Avery and Berlin, 1985; Lo and Noble, 1990; Ciciarelli, 1991; Boge et al., 1992; Hinckley and Walker, 1993). Specific applications to urban/human activities cover a wide range including urban nonpoint pollution assessment (Kim and Ventura, 1993), gully erosion analysis (Welch et al., 1985), historical analysis of urban development into coastal wetlands (Niedzwiedz and Batie, 1984), identifying structural additions to urban residential property (Niedzwiedz, 1990), and studying agricultural land use (Marsh et al., 1990).

Aerial photos have been used to map archeological sites, urban features, and to document changes to the landscape (Smith, 1968). MacConnell (1975) reports the use of black and white aerial photography (scale 1:20000) to map 20 years of land use change within the state of Massachusetts, including the coastal zone. As part of a larger Great Lakes study, the International Joint Commission (1993) used 1:24000 scale photos to map land use features along the Berrien County, Michigan segment of the Lake Michigan shoreline. Results of the photo analysis were used to assess residential riparian erosion/recession rates caused by fluctuating water levels.

Wisconsin's coastal zone includes diverse land use, from forests and wetlands, to land devoted to agricultural or urban uses. The uses of aerial photos long have been applied to study such land uses. Befort and Viliman (1985) studied aerial photos to classify forest habitat. McCarthy et al. (1982) evaluated spruce-fir forests to aid management. Wetlands analysis is possible with aerial photos of appropriate format, scale and seasonal timing. Scarpace et al. (1981) used digitized aerial photos to map wetlands, while Ferguson et al. (1993) and Barrett and Niering (1993) have monitored sawgrass habitat and marsh vegetation change using aerial photos.

Extensive use of aerial photography has been directed at coastal resources. Scherz and Van Domelsen (1973) used aerial photos to help assess water quality in Lake Superior near Duluth, Minnesota. Numerous studies have been made with aerial photos to aid management of coastal resources (Benton et al., 1978; Hill et al., 1985; Norton et al., 1985; Welch et al., 1992), to address

change in coastal wetlands (Lyon and Greene, 1992), and to examine urban development into coastal wetlands (Niedzwiedz and Batie, 1984).

Project Aerial Photos

In 1978, the U.S. Army Corps of Engineers (USACE) obtained panchromatic color aerial photos of the Wisconsin portion of the Lake Michigan coastline. In 1992, USACE obtained color aerial photo coverage of the Wisconsin portion of both Lake Superior and Lake Michigan coastlines. Both the 1978 and 1992 photos were flown at a scale of 1:6000 (1" = 500') and enlargements made at 1:2400 (1" = 200'). The 1978 photos were taken April 16th. The 1992 photos were flown May 13th.

Unlike most historical aerial photos covering the same area and flown at the same scale, the USACE photos of 1978 and 1992 were not flown with coincident photo centers or coverage. No individual flight lines were documented for the 1978 photos. Beginning at the Michigan border, the 1978 photos were taken incrementally to the Illinois border. Photos are documented with the photo date and photo number on the northern edge of each photo.

Flight lines were documented for the 1992 photos. The northern edge of each 1992 photo displays the photo date, flight line and photo number.

Both the 1978 and 1992 photo contact prints (1:6000) were flown to produce stereo coverage of the coastline. Adjacent photos overlap (endlap) about 60% with each other. The enlarged photos (1:2400) available for this study represent every other photo contact print, therefore, only photographic, not stereo coverage, is provided by the enlarged photos. Approximately 1,800 photos (1:2400) cover Wisconsin's Lake Michigan shoreline, 900 for each flight year. About 1,200 photos covering the shoreline from Marinette to Sheboygan are on file at the Green Bay office of USACE. The Waukesha office of USACE has on file about 600 photos covering the shoreline from Sheboygan to the Illinois border. About 460 1992 photos cover the Lake Superior shoreline. These photos are on file at the Two Harbors, Minnesota office of USACE.

Photo Preparation

Photos used in this study are owned by USACE. As a result, all photo documentation and interpretive work was applied to acetate affixed to each photo. Preparing photos for interpretation included the following:

1. Affix label and document photo number/flight line, photo date and Public Land Survey System (PLSS) information.
2. Mark photo fiducials (orange ink). Fiducials allow the registration of acetate overlays to the photos, if required.

3. Mark control points (orange ink). Typically these points are road intersections and/or buildings, stable objects that could be referenced against controlled maps for future mapping applications.
4. Locate and mark interpretation boundary lines (black ink). These lines are used to denote a common boundary between adjacent photos. Land use interpretive lines end at these boundary lines, which eliminates redundant interpretive work.
5. Locate, mark and label PLSS section lines (red ink).
6. Locate, mark and label civil boundary lines (green ink).
7. Locate and mark 1,000' coastal zone boundary line (blue ink). A divider was used to scribe a line 1000' away and parallel to the line defined by land meeting water. In cases where large streams entered Lake Michigan, a straight dashed line was drawn to represent a continuation of the shoreline.
8. Locate and mark top of bluff, and bottom of bluff if slumpage is evident (black ink). In practice, these lines were not drawn until the shoreline portion of the classification scheme was applied to the photos. Refer to the section Photointerpretive Process (page 11) for additional discussion.

Aerial Photo Interpretation (API)

The landscape within the coastal zone can represent a complex mix of natural to urban uses. The land use classification scheme developed for this study addresses the complexity of Wisconsin's coastal zone. The scheme is a modification of the scheme developed by the International Joint Commission (1993) and includes the general use categories of residential, commercial, industrial, transportation, extractive, agricultural, natural, open land and other uses. Land uses have been measured by area (acres, hectares). Structures per land use have been located and marked for spatial reference. Structures are tallied by type for 1992.

Modification of the shoreline also has resulted. Sea walls, revetments, groins and permanent docks have been constructed. Sea walls and revetments are linear types. Their interpretation and measurement are presented in feet (meters). Groins and docks were counted.

CLASSIFICATION SCHEME

Residential Land

All residential areas include infrastructure to service the area. Boundary placement is made to separate residential areas by type. No attempt is made to distinguish roads/streets from the residential areas they serve. This convention is true for other classification types as well.

111 Multi-Family: Medium to High Rise. Large residential structure of five (5) or more stories. Access roads, parking areas, open space and recreational facilities associated with the structure(s) would be included in the type.

112 Multi-Family: Low Rise. Large residential structures up to four (4) stories. Access roads, parking areas, open space and recreational facilities associated with the structure(s) would be included in the type.

113 Single Family, Duplex. Structures large and small used for residential use. The type includes lawn, landscaped areas, garage and driveways. Duplex structures are identified by twin driveways or a very wide driveway leading to an architecturally balanced structure.

115 Mobile Home Park. Residential area developed exclusively for mobile units.

Commercial and Industrial Land

Commercial land includes three (3) types: central business district; shopping center/mall; and, neighborhood business district. Each type includes all building structures, access roads/streets, parking facilities and other features commonly associated with each type.

121 Central Business District (CBD). Commercial land predominantly used for distribution or merchandizing of goods and services. Stores, hotels, office buildings, parking facilities and smaller warehouses constitute the components of this type. The CBD spatially is tight, vegetation is rare.

122 Shopping Center/Mall. These commercial areas have developed away from the CBD. The type includes both "strip" type development and malls. Structures can range from large, flat roofed and rectangular (centers) to large, geometrically shaped. Both types include large parking areas adjacent to or completely surrounding the commercial structures.

124 Neighborhood Business District (NBD). This type denotes small commercial areas within, or adjacent to residential areas. The type may be found in established or newer subdivision areas. NBD structures can range from conventional architecture to unusual geometric shapes. Small parking areas are associated with NBD commercial areas.

126 Institutional Land. The type reflects areas devoted to public or quasi-public uses. Examples include schools, churches, hospitals, prisons, etc., and their associated "grounds," green space, landscaping and parking facilities. When located within the CBD, public buildings without "grounds" often cannot be identified on aerial photos and would be classified as commercial (121).

Industrial Land

138 Industrial Park. The type includes both heavy and light industrial use areas.

Heavy industrial land contains facilities for the manufacture, storage and assembly of raw or partially processed products such as machinery, metals, chemicals, petroleum, or electrical power. Such industries often have large smokestacks and large storage areas. Warehouses and transportation facilities for bulk products and an open and interrupted street pattern characterize this type.

Light industrial land contains facilities for the manufacture or assembly of smaller, partially processed products such as electronics, appliances, and other secondary process products. Large smokestacks or raw material storage facilities are never present. Many modern light industries are well landscaped and are indistinguishable from commercial activity on aerial photographs.

Transportation Land

141 Air Transportation. Includes areas with airports and associated facilities, landing strips, hangers, parking areas and adjacent open areas.

142 Rail Transportation. This type includes railyards, terminal freight and storage facilities as well as stations for passengers. The type may include liquid storage facilities such as tank farms.

143 Water Transportation. This designation is applied to several water-based areas, including docks, warehouses and related land-based facilities for water transportation and commercial fishing. The type includes, as well, public marinas and their associated facilities: boat slips, buildings and parking areas.

143.1 Private Marina. Boat mooring areas adjacent to residential land are designated as private marinas. Often such areas include a protected slip(s), dredged waterway, and/or a permanent docking structure built into the waterway.

143.2 Public Boat Landing. This type is applied to boat launching areas. Typically, facilities include only a ramp(s) from which boats may be launched and parking areas.

144 Divided Highway. This type includes transportation corridors with median strips between lanes. Typically, such roads are four or more lanes wide. Local streets are not included in this type.

145 Communications. Facilities and structures devoted to communications. These include radio/television towers, lighthouses and their grounds, buildings and parking areas.

146 Utilities. This type includes facilities for the production and distribution of energy. Such areas can include large buildings, towers, roads/parking facilities and, in the case of coal fired plants, large piles of raw coal.

147 Sewage Treatment Plant. Buildings, treatment lagoons, parking areas, access roads and grounds are included in this type.

148 Landfill. Landfill sites used to bury garbage define this type. Landfills cover an extensive area and are dominated by large excavated areas, mounds of exposed soil and access roads.

Extractive Land Use

171 Open Pit. The type represents open pit mining areas for extraction of sand, gravel, stone or rock. The type includes access roads and any structures.

172 Underground Mine. Mining of underground resources via shaft extraction. Surface features captured on aerial photos would be limited to small structures and access roads.

173 Well. Features associated with wells are limited. Identification of wells using only aerial photos is difficult.

179 Other Extractive Uses.

Agricultural and Natural Land

181 Abandoned Field (AF). These are agricultural units reverting to wild land. Woody vegetation and grass are abundant but tree crown cover is less than 30%. If tree crown cover were greater than 30%, the land would be classified as forest.

182 Agriculture Active (AG). Tilled or tillable crop land which is or recently has been intensively farmed. The boundaries on the ground usually are sharply defined and well maintained. The land supporting farm buildings is included as part of this type.

183 Forest (F). Areas of forest, deciduous, coniferous or mixed, having canopy closure of at least 30%. Areas with less than 30% canopy closure are classified as abandoned field.

184 Heath (H). Areas of heath plant community as well as grass, shrubs, and other low vegetation found on poor sandy soils.

185 Open Water (W). Areas of open water found in lakes, rivers and large streams. Water depth is greater than three feet during the growing season. The boundary of coastal water is located by drawing a line at the river mouth to connect the edges of the coastline, or man-made features like roads, railroads or bridges crossing rivers or inlets are used to establish such a line.

186 Rock Ledge (RL). Rock outcrop areas at the coastline or within the coastal zone. Such outcrops are common in Door County.

187 Slump Zone (SL). Land located between upland bluff and beach. Slump zones begin at the bluff line and slope down to the beach.

188 Wetland (WT). This type covers the full spectrum of wetlands. These include seasonally flooded flats, shrub swamps, meadows, bogs, shallow and deep marshes, and forested wetlands. Each is described below.

Seasonally flooded basins or flats occur principally on stream floodplains. The most common plants are grasses and herbaceous species. The soil is waterlogged or covered with water during spring freshets, but well-drained during the growing season.

Shrub swamps often have waterlogged soil during the growing season, as much as six (6) inches of water may be present. Vegetation types include elder, buttonbush, dogwood and willow. Sedges usually are present in tussocks.

Meadows are vegetated with grasses, rushes and sedges. Soils are waterlogged through most of the growing season. Surface water is present only for a short period during the spring.

Bogs are unique wetland types that support a distinctive plant community, including most of the following: heath shrubs, cranberries, pitcher plants and sedges. Scattered black spruce, tamarack and red maple may be present. A mat of sphagnum moss is the most common feature of bogs.

Shallow marsh is wetter than meadow. The soil is completely waterlogged and often covered with up to six inches of water during the growing season. The predominant vegetation is emergent, including such plants as cattails, bulrushes, burreed, pickerelweed and arrowhead with some grasses and sedges present. The type is common to open water bodies.

Deep marsh has water depth ranging from six inches to three feet. Fairly large open water areas are bordered by, or interspersed with, emergent vegetation like that found in shallow marsh. Floating and submergent plants such as water lilies, duckweed, watershield and pondweeds also are present.

Forested Wetlands. This type represents areas of moist to saturated soil covered by forest canopy. The type is difficult to identify without stereo photography and,or with "leaves-on" photography.

Open and Other Land

191 Outdoor-Public Assembly

192 Urban Open Lots. Urban open is undeveloped land lying idle in the midst of urban areas or adjacent to them. This type includes land which has been cleared for urban development of an unknown use.

193 Outdoor Recreation. Outdoor recreation types are either mainly for participation, mainly for spectators, or are environmental in character. Each recreational type includes the recreational complex: access roads, parking facilities, buildings and other related facilities.

194 Cemeteries

Shoreline Modification

Development along the lakeshore often means modification at, or near, the shoreline. Land along the lakeshore is exposed to significant erosional forces. Recession of land mass is common. Agricultural and urban land uses destabilize shoreland, in effect accelerating erosion and land recession. To protect real estate and property, many property owners have constructed walls or revetments along their shoreline. Some owners also have built non-flow-through docks at the shoreline to provide mooring and protection for their boats. Groins, large rock structures perpendicular to the shoreline, have been built along Wisconsin's Lake Michigan shoreline.

195 Sea Walls (V 195 V). These structures are built parallel to the shoreline and typically are well defined, linear

features. Construction materials can include concrete, wood or interlocking sheet steel.

196 Revetments (V 196 V). Large rock or slab structures built parallel to the shoreline. Interpretively, revetments are less well defined, and appear wider than do sea walls.

197 Groins (* [red]). Groins are large rock structures built perpendicular to the shoreline into the water. Except for their distinct orientation and placement, groins appear similar to revetments.

198 Non-Flow-Through Dock (* [blue]). Such docks are permanent structures built into near-shore waters. Typically these docks are straight, their upper surface wide and well defined.

Structures - Industrial, Commercial and Residential

On the 1992 photos, buildings within the coastal zone are classified by type and location. Using a template of rectangles, for each building, a rectangle is selected that best represents the area of the building's "footprint." The selected rectangle then is positioned so that the leading edge of the building (relative to the shoreline) is located. Green ink was used to represent commercial/industrial/institutional buildings while red ink was used for residential buildings.

THE PHOTOINTERPRETIVE PROCESS

After photo preparation, each photo was interpreted using the classification scheme defined above. Area (land uses), linear (shoreline modification) and point (urban structures, groins, docks) types are represented in this study. Lines and/or symbols were used to define all types. Area types are represented by perimeter boundary lines and symbols to define and identify the areas. Line types representing modification to natural shoreline were defined using both lines and symbols. All area and line type symbols are recorded in black ink. Point types are defined by symbols and colored ink (see above).

Modifications to the shoreline, such as sea walls or revetments, are delineated by placing (painting) the 'V' symbol at the beginning and end of the modification. The type of modification is represented by placing the appropriate number between the 'V' symbols. For example, 195 positioned between two 'V' symbols means that a sea wall has been built along this section of shoreline. Shoreline classification was conducted before land use so that land use boundary lines placed along the shoreline would not 'hide' shoreline information.

Groins and non-flow-through docks were defined by point symbols (see above). In both cases, the symbol was placed at the point where the structure meets land. As discussed above, for

1992, buildings also were classified using point symbols. The delineation of buildings represents the last API procedure.

MEASUREMENT OF AREA, LINE AND POINT TYPES LOCATED WITHIN THE COASTAL ZONE

Area types (land use polygons) and line types (shoreline modification) measurements were made using the hardware/software facilities of the GIS Lab at the University of Wisconsin-Green Bay. Photo acetate overlays were affixed to large-format digitizers and each land use polygon digitized along the perimeter. Measurements recorded in square inches were converted to acres/hectares. Line measurements (in inches) of shoreline modifications were made using digitizers as well. Linear inch measurements were converted to linear feet/meters for each type of modification.

Point types (groins, structures) simply were tallied by count for each type. The area covered by each acetate was broken into civil jurisdiction and PLSS section designations. Measurements (above) were separated by civil and PLSS designations as well, and documented permanently on each acetate overlay.

TALLY OF DATA

Measurements recorded on each photo acetate were transferred to data sheets. Three (3) levels of data sheets were used: PLSS Section Data; Civil Jurisdiction Summary Data; and County Summary Data (Appendix).

PLSS Section Data Sheet: One (1) PLSS Section Data sheet was used for each section located on a photo/acetate. Generally, 1-2 PLSS sections are located on a photo, however, up to four (4) sections per photo were recorded. Section level data sheets record photo documentation including photo year, photo number, county and community(ies) covered, and complete PLSS section location. Also recorded were number of residential, commercial, industrial and institutional structures (1992), area of land use by type, linear distance of sea walls and revetments, and the number of groins and non-flow-through docks.

Civil Jurisdiction Summary Data Sheet: This tally sheet summarizes the data for all PLSS section sheets found within each township, village or city. The sheet records photo year, county, name of civil jurisdiction, a complete listing of PLSS sections included in the summary, as well as all land use, shoreline and structure count data discussed above.

County Summary Data Sheet: The County Summary sheet summarizes all data for the towns, villages and cities located within the county. Documented information includes photo year, county name, an alphabetical listing of all civil jurisdictions within the county, and a summary of all land use, shoreline and structure count data reported on Civil Jurisdiction Summary Data sheets.

LIMITATIONS AND SOURCES OF ERROR

The U.S. Army Corps of Engineers contracted for aerial photography of the Wisconsin portion of the Lake Michigan shoreline on April 21, 1978 and May 19, 1992, and of the Lake Superior shoreline on May 28, 1992. All sets of photos are 1:6000 scale and panchromatic color, however, the 1978 photos are "leaves-off" while the 1992 photos are "leaves-on."

Copies of the original stereo photos (1:6000 scale) were not available for this study. Instead, enlargements (1:2400 scale) of the original photos were borrowed from Corps district offices in Green Bay and Waukesha, Wisconsin and Two Harbors, Minnesota. The enlargements provided photographic coverage only, not stereo coverage. Normally, for a project of this magnitude, photos would have been taken to meet the specific objectives of the study. The enlarged photos used for this project present limitations and introduce error beyond what would be reported with original photos flown specifically for this study. Limitations and errors associated with the photographs used are discussed below. Also presented below is discussion regarding methodological inconsistencies.

The following discussion of Limitations and Sources of Error is presented in an attempt to provide the reader a basic understanding of the issues. Any section of the discussion could apply to any of the results reported below. The Results sections of this report present findings without any comprehensive attempt to explain anomalies within, or between, the photo study years (1978 and 1992).

Photo Scale and Enlargements

All vertical aerial photographs not ratioed (enlarged or reduced to a common average scale) or rectified (common tilt/tip corrected to a horizontal reference plane) inherently are scale inaccurate. The original USACE photos (1978 and 1992) were not ratioed or rectified, therefore, their scale varies relative to topographic changes of the coastal zone, tip/tilt of the camera and changing elevation of the camera (aircraft). Enlargements of the original photos simply accentuate the inaccuracies found on the original photos.

Area and linear measurements taken off of the USACE enlarged photos reflect the inaccuracies inherent in those photos. Simple tests of shoreline distances for numerous PLSS sections along the shoreline were conducted to establish linear accuracies of the photos. USGS topo sheets at 1:24000 scale were used to establish base shoreline distance measurements against which photo (1978 and 1992) shoreline distance measurements could be compared. For Lake Michigan no systematic errors were detected for the 1978 photos. However, only one (1) of 21 tests of the 1992 photos varied in the positive direction from USGS measurements. The remaining 20 tests varied in the negative direction and ranged from -0.8% to -13.1%. The range of error for 1978 was -5.3% to

+9.6%, while the range of error for 1992 was -13.1% to +1.9%. Without a test of error for each photo used, there is no means to judge the direction or the amount of error relative to statistics associated with each photo. However, given the range of error found for the 1978 and 1992 photos, it is possible that 1,000 acres (405 ha) (actual) of coastal zone area could be reported as 1,096 acres (444 ha) in 1978 and 869 acres (352 ha) in 1992, a 227 acre (92 ha) difference.

Accuracy tests of 1992 Lake Superior photos indicate a range of error of -4.0% to 2.6% and a mean error of -0.73%. Of the nine (9) tests made, six (6) were negative (below USGS map estimates) while three (3) were positive (see Table 1, page 16).

"Leaves-On" Versus "Leaves-Off" Aerial Photography

There are distinct advantages and disadvantages of both "leaves-on" and "leaves-off" aerial photography. However, given the goals of this project, the 1978 "leaves-off" photography offers important advantages over the 1992 "leaves-on" photography. Vegetation in leaf can hide the details of built structures, including buildings and shoreline modifications. Roads can be hidden under tree crowns, as well as portions of lots landscaped and managed as residential land. Leaved canopies increase the effect of shadows. Shadows mask ground, understory and structural information leading to inaccurate interpretation. Land uses and/or structures hidden under the canopy of vegetation or masked by shadows can be underestimated in area, length or count. Land use types particularly affected (underestimated) are single family residential and wetland.

Stereo Versus Photographic Coverage

Both the 1978 and 1992 photo sets were taken to capture stereo (3-D) coverage of the Lake Michigan coastal area. This means that adjacent photos overlap approximately 60%. Stated another way, 60% of the shoreland area located on one photo also is located on an adjacent photo. The shoreland common to adjacent photos is "seen" from two different perspectives which allows stereo viewing (using a stereoscope).

The enlarged photos borrowed from USACE for this study represent photographic coverage only, or every other photo taken of shoreland. While photo (2-D) coverage at large scales can be used to interpret accurately many land use types (agricultural and most urban land), the lack of stereo viewing makes difficult the identification of wetland types and the exact location of bluff lines. Stereo viewing generally would have increased the interpretive accuracy of most land use, structural and shoreline features.

Incomplete Photo Coverage

For this study, the coastal zone is defined as a 1000′ strip of land adjacent and parallel to the shoreline. Occasionally, photo coverage did not include all shoreland within 1000′ of the water. As a result, total land area is underrepresented, the exact land use types not covered are not known. In such cases, the area not captured on a particular photo was estimated by reference and comparison to coverage photos of the other flight year (Lake Michigan coastal zone only).

Missing Photo Coverage

Occasionally, photo coverage was missing from the USACE photo library. In such cases, as described above, coverage area missing was estimated by reference to photos of the other flight year. However, the exact land use types and shoreline features not represented on photos remain unknown.

Location of 1000′ Coastal Zone Boundary

On each photo set, 1978 and 1992, a boundary line was drawn representing the 1000′ coastal zone parallel to the shoreline. This line was located by scribing a landward line parallel to the line defined by the shoreline (where water meets land). The landward extent of the boundary line is a function of shoreline location, which in turn, is dependent on the water elevation of Lake Michigan. USACE (1978, 1992) reports that in April of 1978 Lake Michigan water elevation was about 578.4 feet (176.3 meters) and about 579.16 feet (176.5 meters) in May, 1992. The nine (9) inch difference in water elevation, while seemingly insignificant, could have shifted substantially landward the shoreline in extremely low slope beach or mud flat areas. The result of such a shift would be inclusion of inland areas NOT included in the 1978 coastal zone.

Lack of Beach Type in Classification Scheme

The width or extent of beach is dependent on slope of an area and water elevation. Since changes in the area of beach likely would reflect more the differences in 1978 and 1992 water levels (9 inches higher in 1992) than actual losses/gains due to erosion or development, no beach type was included in the study.

The lack of a beach type does affect measurement of area within the 1000′ coastal zone. The landward extent of the coastal zone is 1000′ from the shoreline. Any beach area lies between the shoreline and the base of the bluff, however area measurements of land use types were made only for those types lying between the base of the bluff and the interior boundary of the coastal zone. In most cases, beach strips represent only about five (5) acres per photo.

Positional Changes to the Shoreline: Natural vs. Urban Development

As discussed above, the landward extent of the 1000' coastal boundary is dependent on the location of the shoreline. Natural changes to shoreline position include both water elevation and erosion/deposition of soil. Filling of coastal waters to accommodate urban development artificially changes shoreline location. In such cases, not only does the shoreline move "offshore," the interior coastal zone boundary line shifts toward the water. This "shift" in coastal boundaries skews area measurement. For example, in 1978 assume the coastal zone in an area to be all residential and that by 1992 100 acres of lake water is filled to develop commercial land. A "lakeward" shift in the location of the shoreline will occur due to the land filled for commercial use. However, this "shift" in the shoreline created by the filled commercial site also will result in a shift toward the water of the interior coastal zone boundary. The effect of the latter shift will be that 100 acres of residential land will not be included as part of the 1992 coastal zone. In such a case, the "raw' statistics misleadingly suggest that 100 acres of residential land use were eliminated to make room for 100 acres of commercial use.

Table 1. County Results of Linear Accuracy Tests

Percent Deviation From USGS Base Map Measurements

	1992 Enlarged Photos (1:2400)
Ashland County	
Odanah	-0.2%
Ashland	-3.4%
Bayfield County	
Ashland	+2.6%
Bayfield (a)	+1.1%
Bayfield (b)	-4.0%
Cornucopia	-0.5%
Port Wing	-1.5%
Douglas County	-3.3%
Iron County	+2.6%
Mean	-0.73%
Range	-4.0% to 2.6%

RESULTS - ASHLAND COUNTY

Ashland County communities lying within the Lake Superior coastal zone include the township of Sanborn and the city of Ashland. The area measured within the coastal zone of Ashland was 3,222 acres (1,305 ha).

Statistical summaries for Ashland County and all communities included in this study are located in the Appendix.[1] Summary data sheets present land use types by area, 1992 structural counts by type, shoreline modification types by length, and a count of shoreline structures by type. Data were collected at the PLSS section level. The section level data sheets are not included in this report.

Residential Land

Within the coastal zone of Ashland County, 710 residential structures were identified on 201 acres (81 ha) of land. This total includes 417 residential units (single family or duplexes), 174 detached garages, 112 sheds and (7) mobile homes. Since the 1992 photos are "leaves-on," these numbers likely underestimate the actual number of structures and area devoted to residential uses.

Commercial Land

Commercial land represented 124 acres (50 ha) in 1992. Within the coastal zone area, 99 structures were located in the central business district while 118 structures were of the type neighborhood business district. Eight (8) institutional structures also were recorded on 11.2 acres (4.6 ha) of coastal zone area. Land devoted to CBD covered 28 acres (11.4 ha) while land devoted to neighborhood business covered 85 acres (34 ha).

Industrial Land

Industrial land covered 57 acres (23 ha) of coastal zone on which were located 27 structures.

Transportation Land

Thirty-nine (39) structures were located on 99 acres (40 ha) of land in 1992. Of the total area were 10.3 acres (4.2 ha) of rail transportation, 9.8 acres (4 ha) of private marina (14 structures), 33 acres (13.4 ha) of highway, 28 acres (11.2 ha) of

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[1]Area figures used in the Results discussion reflect totals (not rounded) reported on the original tally sheets. Figures presented on the tally sheets found in the Appendix of this report have been rounded to the nearest whole number.

utility (18 structures), 6.2 acres (2.5 ha) of sewage treatment facility, and (5) acres (2 ha) of landfill area.

Extractive Land

No extractive land uses were recorded within the coastal zone.

Agricultural and Natural Land

Agricultural and natural lands covered 2,705 acres (1,096 ha) of the coastal zone in 1992, or 84% of all coastal zone area. Of total coastal zone area were 103 acres (42 ha) of abandoned field, 1,333 acres (540 ha) of forest, 246 acres (100 ha) of heath, 226 acres (91 ha) of open water, 24 acres (9.5 ha) of slump zone, and 774 acres (314 ha) of wetland.

Open and Other Land

A total of 35 acres (14 ha) were identified within this type, on which 13 structures were located. Open/other land included 2.8 acres (1.1 ha) of outdoor-public assembly (2 structures), 4.5 acres (1.8 ha) of urban open lot, and 28 acres (11.3 ha) of outdoor recreation (11 structures).

Shoreline Modifications

Ostensibly, sea walls and revetments are used to protect shorelines from erosion. In 1992, 5,375 feet (1,639 m) of sea wall and 13,343 feet (4,068 m) of revetment were documented along the county's shoreline. Additionally, (7) groins and (3) non-flow-through docks were identified.

Results by Community

City of Ashland

The area of coastal zone located within the city of Ashland was measured at 719 acres (291 ha). A total of 880 structures were identified within the city's coastal zone.

In 1992, 581 residential structures were located on 143 acres (58 ha) of land. Most of these structures (337) were single family or duplex units. Seven (7) structures were identified as mobile homes. Other structures associated with residential use included 159 detached garages and 78 sheds.

A total of 124 acres (50 ha) of land was devoted to commercial use, on which 225 structures were located. CBD covered 28 acres (11.4 ha) and included 99 structures. Land devoted to neighborhood business district covered 85 acres (34 ha), on which 118 structures were observed. Eight (8) institutional structures were identified on 11.2 acres (5.6 ha) of land.

Industrial land within the city's coastal zone totaled 57 acres (23 ha) and included 27 structures.

Land use types within the transportation category covered 96 acres (39 ha). A total of 34 transportation structures were located within the coastal zone. Transportation types observed included rail transportation (10.3 acres [4.2 ha]), water transportation (3 acres [1.2 ha]), private marina (9.8 acres [4 ha] - 14 structures), public boat landing (1 acre [.4 ha]), highway (33 acres [13.4 ha]), utility (28 acres [11.2 ha] - 18 structures), sewage treatment (6.2 acres [2.5 ha] - [2] structures), and landfill (5 acres [2 ha]).

No extractive areas were observed within the city's coastal zone.

Agricultural and natural areas covered 265 acres (107 ha) or 36.8% of total coastal zone area. Land use types within this category included 79 acres (32 ha) of abandoned field, 147 acres (59 ha) of active agricultural land, 15 acres (6 ha) of open water, and 23 acres (9.3 ha) of wetland.

Within the open/other land use category, 12 structures were observed on 35 acres (14.1 ha) of land. Land use types within the category include 2.8 acres (1.3 ha) of outdoor-public assembly ([2] structures), 4.5 acres (1.8 ha) of urban open lot, and 27.5 acres (11.1 ha) of outdoor recreation (10 structures).

In 1992, 4,453 feet (1,358 m) of sea wall were documented along the shoreline of the city. Revetment structures were built along 11,316 feet (3,450 m) of shoreline. Other structures observed along the shoreline included six (6) groins and three (3) non-flow-through docks.

Town of Sanborn

The coastal zone of Sanborn consisted of 2,502 acres (1,013 ha) and included 135 structures. Most of the town's coastal zone (97%) consisted of agricultural and natural cover types.

Residential land within the town's coastal zone covered only 57.5 acres (23.3 ha). A total of 129 structures were located on residential land, including 80 single family or duplex units, 15 detached garages and 34 sheds.

No commercial, industrial or extractive use types were observed within the town's coastal zone.

Transportation land covered 3.4 acres (1.4 ha) and consisted of two types: public boat landing (1.1 acres [.4 ha]) and communications (2.3 acres [.9 ha]) - [5] structures).

As stated above, 97% of Sanborn's coastal zone was covered by land use types of the agricultural and natural category. Types observed included 24 acres (9.6 ha) of abandoned field, 1,187 acres (481 ha) of forest, 246 acres (100 ha) of heath, 211 acres (85 ha) of open water, 23 acres (9.2 ha) of slump zone and 751 acres (304 ha) of wetland.

Open/other land consisted only of .53 acres (.2 ha) of outdoor recreation ([1] structure).

Modifications to the town's shoreline consisted of 922 feet

(281 m) of sea wall and 2,027 feet (618 m) of revetment. One (1) groin was observed.

RESULTS - BAYFIELD COUNTY

Bayfield County communities lying within the Lake Superior coastal zone include the townships of Barksdale, Bayfield, Bayview, Bell, Clover, Eileen, Orienta, Port Wing and Russell, and the cities of Bayfield and Washburn. The area measured within the coastal zone of Bayfield County was 9,813 acres (3,974 ha). Over 93% of the county's coastal zone consisted of land cover types of the agricultural and natural lands category.

Statistical summaries for Bayfield County and all communities included in this study are located in the Appendix.[2] Summary data sheets present land use types by area, 1992 structural counts by type, shoreline modification types by length, and a count of shoreline structures by type. Data were collected at the PLSS section level. The section level data sheets are not included in this report.

Residential Land

Within the coastal zone of Bayfield County, 1,304 residential structures were identified on 384 acres (156 ha). This total includes 804 residential units (single family or duplexes), 202 detached garages, 276 sheds, (9) mobile homes and (7) low-rise multi-family units. Over 98%, 378 acres (153 ha) of all residential land was covered by the type single family or duplex.

Commercial Land

Commercial uses covered 73 acres (30 ha) of the coastal zone. A total of 143 commercial structures were observed. Types identified included 65 acres (26 ha) of neighborhood business district (135 structures) and 8.3 acres (3.4 ha) of institutional land (8 structures).

Industrial Land

Industrial land covered 18.7 acres (7.6 ha) of coastal zone area on which (7) structures were noted.

Transportation Land

Five types of transportation land totaling 112 acres (45 ha) were observed within the county's coastal zone. Private marina made up nearly 70% (78 acres [32 ha] - 42 structures) of all transportation land. Other transportation types included public

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[2]Area figures used in the Results discussion reflect totals (not rounded) reported on the original tally sheets. Figures presented on the tally sheets found in the Appendix of this report have been rounded to the nearest whole number.

boat landing (3.7 acres [1.5 ha] - [3] structures), utilities (.8 acres [.3 ha]), and sewage treatment facilities (9.6 acres [3.9 ha] - [4] structures).

Extractive Land

No extractive land uses were observed within the county's coastal zone.

Agricultural and Natural

Types within this category cover 93% (9,148 acres [3,705 ha]) of the county's coastal zone. Land cover types within the agricultural and natural category include 279 acres (113 ha) of abandoned field, 85 acres (34 ha) of active agricultural land, 67 acres (27 ha) of heath, 210 acres (85 ha) of open water, 92 acres (37 ha) of slump zone, and 666 acres (270 ha) of wetland. The largest single type within this category was forest. Forest covered 7,750 acres (3,139 ha) or nearly 85% of all area covered by types of this category.

Open and Other Land

Only 76.5 acres (31 ha) of open/other land was delineated within Bayfield County's coastal zone. Of this total were 3.9 acres (1.6 ha) of urban open lot, 72 acres (29 ha) of outdoor recreation, and .8 acres (.3 ha) of cemetery. A total of 24 structures were located on land devoted to outdoor recreation.

Shoreline Modifications

Ostensibly, sea walls and revetments are used to protect shorelines from erosion. In 1992, 6,914 feet (2,108 m) of sea wall and 11,623 feet (3,544 m) of revetment were documented. Also tallied along the county's shoreline were 10 groins and (5) non-flow-through docks.

Results by Community

Town of Barksdale

Barksdale's coastal zone consisted of 686 acres (278 ha) in 1992. A total of 164 structures were identified within the coastal zone, all located on residential land.

Residential land covered 58 acres (23.5 ha). All residential acreage was of the type single family/duplex. Structures located within this type included 92 single family/duplex units, 31 detached garages, 40 sheds and (1) barn.

Less than one (1) acre of commercial land was located within the town's coastal zone. No industrial or extractive types were observed.

Land devoted to transportation was measured at 8.4 acres (3.4 ha). Transportation types included .8 acres (.3 ha) of public boat landing, 7.5 acres (3 ha) of highway, and .1 acre (.05 ha) of utility.

Fully 90% of all coastal zone area fell into the agricultural and natural land use category. Land use types within the category included 50 acres (20 ha) of abandoned field, 4.4 acres (1.8 ha) of active agricultural land, .3 acres (.1 ha) of heath, 10.8 acres (4.4 ha) of open water, .6 acres (.2 ha) of slump zone, and 62 acres (25 ha) of wetland. Forest land, however, represented over 79%, or 491 acres (199 ha), of the total acreage of the agricultural and natural category.

Within the town's coastal zone, no open or other land use types were observed.

A total of 124 feet (38 m) of sea wall and 2,252 feet (687 m) of revetment were recorded along the town's shoreline. One (1) groin also was tallied.

City of Bayfield

The city's coastal zone covered 153 acres (62 ha) in 1992, on which 289 structures were observed.

A total of 187 residential structures were tallied on 53 acres (21.4 ha) of residential land. The residential type single family/duplex covered 52 acres (21 ha). Structures associated with this type included 127 single family/duplex units, 31 detached garages and 29 sheds. Nine (9) mobile homes also were tallied on 1.2 acres (.5 ha) of land.

Commercial land included two types covering 32 acres (12.8 ha). Neighborhood business district totaled 28 acres (11.3 ha) on which 69 structures were located. Institutional land held (6) structures on 3.7 acres (1.5 ha).

No industrial or extractive cover types were observed within the city's coastal zone.

Land devoted to transportation totaled 27.3 acres (11 ha), almost all of which was located within private marina (27.2 acres [11 ha]). Land devoted to private marina held 26 structures.

Three (3) types within the agricultural and natural land use category covered 37 acres (14.9 ha). These types included 6.9 acres (2.8 ha) of abandoned field, 30 acres (12 ha) of forest, and .24 acres (.1 ha) of open water.

The city's coastal zone included 4.5 acres of land devoted to two (2) types of the open/other use category. Urban open lot covered 3.1 acres (1.3 ha) while land devoted to outdoor recreation covered 1.4 acres (.6 ha). One (1) structure was observed on outdoor recreation land.

Shoreline modifications within the city's coastal zone included 652 feet (199 m) of sea wall and 3,272 feet (998 m) of revetment.

Town of Bayfield

The coastal zone of the town of Bayfield was measured at 1,731 acres (701 ha) and included 100 structures.

A total of 89 residential structures were counted on 35 acres (14.1 ha) of land area. All structures were associated with the type single family/duplex, including 56 single family or duplex units, 14 detached garages and 19 sheds.

Commercial land covered 7.1 acres (2.9 ha) and consisted of two types: neighborhood business district (5.5 acres [2.2 ha] - [6] structures), and institutional land (1.7 acres [.7 ha] - [1] structure).

Within the coastal zone no industrial or extractive uses were recorded.

Two (2) transportation types were observed covering a total of 19.6 acres (7.9 ha) of area. Private marina consisted of 16.9 acres (6.8 ha) and (3) structures while sewage treatment facilities covered 2.7 acres (1.1 ha) and included (1) structure.

Agricultural and natural land use types totaled 1,669 acres (676 ha) which represents over 96% of Bayfield's coastal zone. Within this category, forest covered 1,551 acres (628 ha) or 93% of category area. Other types within the category include 23.5 acres (9.5 ha) of abandoned field, 5.5 acres (2.2 ha) of active agricultural land, (1) acre (.4 ha) of heath, 16.8 acres (6.8 ha) of open water, 3.8 acres (1.5 ha) of slump zone and 68 acres (27 ha) of wetland.

No land devoted to open or other use types was observed within the town's coastal zone.

The town's shoreline modifications consisted of 1,055 feet (322 m) of sea wall and (1) non-flow-through dock.

Town of Bayview

Bayview's coastal zone covered 845 acres (342 ha) and included 104 structures, most of which (103) were associated with residential land.

Residential land totaled 26 acres (10.5 ha), all tallied within the single family/duplex type. Associated structures included 60 single family/duplex units, 25 detached garages and 18 sheds.

No commercial, industrial or extractive use types were documented within the town's coastal zone.

Less than (1) acre of transportation land (public boat landing) was observed within the coastal zone. One (1) associated structure was tallied.

Agricultural and natural land uses covered 819 acres (332 ha), representing nearly 97% of the total coastal zone area. Forest land covered 678 acres (275 ha), accounting for 83% of all acreage within the category. Other types within the category included 28 acres (11.2 ha) of abandoned field, 2.5 acres (1 ha) of active agricultural land, 10.4 acres (4.2 ha) of heath, 9.2

acres (3.7 ha) of open water, .4 acres (.15 ha) of slump zone, and 91 acres (37 ha) of wetland.

The coastal zone of Bayview did not include any types within the open/other land use category.

Shoreline modifications consisted of 246 feet (75 m) of sea wall, 70 feet (21 m) of revetment, and (3) groins.

Town of Bell

The coastal zone of Bell covered 1,128 acres (457 ha) and included 249 structures.

Most structures (230) were located on 61 acres (25 ha) of residential land. All residential acreage was of the type single family/duplex. Structures associated with residential land included 152 single family/duplex units, 38 detached garages and 40 sheds.

Only 2.7 acres (1.1 ha) of commercial land was identified within the town's coastal zone, including (8) commercial structures.

No industrial or extractive uses were documented within the town's coastal zone.

One (1) transportation type was identified within the coastal zone. Private marina covered 11.1 acres (4.5 ha) on which 10 structures were identified.

Fully 93% (1,052 acres [426 ha]) of the town's coastal zone consisted of agricultural and natural land use types. Of types recorded, forest land covered the largest area, 916 acres (371 ha) or 87% of all agricultural and natural category area. Other types observed include 13 acres (5.4 ha) of abandoned field, 12.2 acres (4.9 ha) of active agricultural land, 37 acres (15 ha) of heath, 11.8 acres (4.8 ha) of open water, (7) acres (2.8 ha) of slump zone, and 55 acres (22 ha) of wetland.

Less than (1) acre of land was devoted to open/other category types. Outdoor recreation land covered .7 acres (.3 ha) and included (1) structure.

No sea walls or revetments were observed along the township's shoreline. One (1) groin and (1) non-flow-through dock were tallied.

Town of Clover

The coastal zone of the town of Clover covered 1,231 acres (499 ha) on which 200 structures were observed.

Most structures (185) were located on 65 acres (26 ha) of residential land. All structures were associated with the type single family/duplex and included 97 single family/duplex units, 24 detached garages, 60 sheds and (4) barns.

Commercial land within the coastal zone covered 3.1 acres (1.3 ha) and included 11 structures. Both acreage and structures were associated with the type neighborhood business district.

No industrial or extractive lands were observed within the town's coastal zone. Only 1.5 acres (.6 ha) of transportation

land was observed within the coastal zone, all assigned to public boat landing.

Almost 94% (1,157 acres [469 ha]) of all coastal zone area was determined to be agricultural or natural. Forest land represented 770 acres (312 ha) or over 66% of all category area. Other agricultural and natural category types included 84 acres (34 ha) of abandoned field, 19 acres (7.7 ha) of active agricultural land, 1.7 acres (.7 ha) of heath, 77 acres (31 ha) of open water, 33 acres (13.3 ha) of slump zone, and 173 acres (70 ha) of wetland.

One (1) land use type of the open/other use category was observed within the town's coastal zone: outdoor recreation - 4.8 acres (1.9 ha) and (2) structures.

The town's shoreline has been modified by construction of sea walls, revetments and groins. Sea walls were observed along 45 feet (13.8 m) of shoreline while revetments were observed along 1,162 feet (354 m) of shoreline. Two (2) groins were tallied.

Town of Eileen

Only 112 acres (45 ha) of the township fell within the coastal zone area. Of these, 2.1 acres (.8 ha) were classified as residential single family/duplex. Two (2) residential structures were observed.

Commercial land covered 3.6 acres (1.5 ha) of coastal zone, all of which fell within the neighborhood business district type. Four (4) structures associated with this type were recorded.

No industrial or extractive uses were observed within the town's coastal zone.

Highway was the only transportation type identified within the coastal zone. Highway area totaled 12.5 acres (5 ha).

Just under 94 acres (38 ha) of agricultural and natural category uses were recorded. Individual types observed include .3 acres (.1 ha) of abandoned field, 10 acres (4 ha) of forest, 30 acres (12 ha) of heath, and 54 acres (22 ha) of wetland.

No land within the open/other category was observed.

Modifications to the town's shoreline was limited to one (1) type. A total of 2,244 feet (684 m) of revetment were documented.

Town of Orienta

Orienta's coastal zone covered 729 acres (295 ha) on which 67 structures were located.

Residential land consisted only of the single family/duplex type. This type covered 16.7 acres (6.8 ha). Structures associated with the type include 34 single family/duplex units, (7) detached garages, and 20 sheds.

Commercial land within the coastal zone consisted of 4.2 acres (1.7 ha) all falling into neighborhood business district. Four (4) structures were associated with this type.

The town's coastal zone included no industrial, transportation or extractive uses.

Land cover types of the agricultural and natural category represented nearly 97% (705 acres [286 ha]) of total coastal zone area. Within the category, forest land covered 625 acres (253 ha) or 88.6% of the category total. Other category types include 39 acres (16 ha) of abandoned field, .8 acres (.3 ha) of heath, 11.6 acres (4.7 ha) of open water, 16.3 acres (6.6 ha) of slump zone, and 12.7 acres (5.1 ha) of wetland.

Outdoor recreation was the only type observed of the open/other use category. The type covered 2.6 acres (1.1 ha) and included (2) structures.

The town's shoreline was modified with 195 feet (60 m) of sea wall and 1,096 feet (334 m) of revetment.

Town of Port Wing

Port Wing's coastal zone consisted of 857 acres (347 ha) on which 51 structures were documented.

A total of 18.7 acres (7.6 ha) of residential land was documented within the town's coastal zone. All acreage was assigned to the single family/duplex type. A total of 45 residential structures were recorded, including 27 single family/duplex units, (4) detached garages, 13 sheds and (1) barn.

Only .9 acres (.4 ha) of commercial land was measured within the town's coastal zone. Two (2) commercial structures were noted.

No industrial or extractive uses were located within Port Wing's coastal zone.

Two (2) transportation category types covering 4.9 acres (2 ha) were observed. Land devoted to private marina covered 3.1 acres (1.3 ha) while public boat landing covered 1.8 acres (.7 ha) and included (2) structures.

Agricultural and natural lands covered 828 acres (335 ha) representing nearly 97% of all coastal zone area. Of all category types, forest (647 acres [262 ha]) represented 78% of total category area. Other category types included 18 acres (7.2 ha) of abandoned field, 4.9 acres (2 ha) of active agricultural land, 13 acres (5.3 ha) of heath, 32 acres (13 ha) of open water, 30 acres (12.2 ha) of slump zone, and 84 acres (34 ha) of wetland.

One (1) type of the open/other use category was observed within the town's coastal zone. A total of 4.3 acres (1.7 ha) of outdoor recreation land was recorded. The area included (1) structure.

Shoreline modifications within the town included 510 feet (155 m) of sea wall, (1) groin and (1) non-flow-through dock.

Town of Russell

The coastal zone within the town of Russell consisted of 1,966 acres (796 ha) and included 131 structures. Photo coverage

for Russell was incomplete. Approximately 3,224 feet (983 m) of shoreline was not covered by the 1992 aerial photos. This estimate was based upon measurements taken from USGS quad maps at 1:24000.

Residential land within the township covered 44 acres (18 ha). There were 116 residential structures located on residential land. Most residential land (40 acres [16.4 ha]) was classified as single family/duplex, an additional 3.3 acres (1.3 ha) were classified as low-rise multi-family. Residential structures included 64 single family/duplex units, (9) detached garages, 17 sheds and (6) low-rise multi-family structures.

A total of (9) commercial structures were located on 7.8 acres (3.2 ha) of land. All commercial acreage was classified as neighborhood business.

Industrial land covered 5.4 acres (2.2 ha) of the coastal zone. Only (1) industrial structure was identified.

Two (2) structures were identified on 7.2 acres (2.9 ha) of land devoted to transportation. All transportation acreage was classified as private marina.

No extractive uses were observed within the coastal zone of Russell.

Land devoted to agricultural and natural uses covered 1,886 acres (764 ha) or 96% of the coastal zone area. Within the category, forest land represented 1,794 acres (727 ha) or 95% of total area. Other agricultural and natural types included 15.6 acres (6.3 ha) of abandoned field, 2.4 acres (1 ha) of heath, (9) acres (3.6 ha) of open water, .8 acres (.3 ha) of slump zone, and 65 acres (26 ha) of wetland.

The category of open/other land included two (2) types covering a total of 15.3 acres (6.2 ha). Types represented include 14.5 acres (5.9 ha - [3] structures) of outdoor recreation and .8 acres (.3 ha) of cemetery land.

Shoreline modifications included 1,739 feet (530 m) of sea wall and 539 feet (164 m) of revetment. Additionally, (1) non-flow-through dock was observed.

City of Washburn

The coastal zone of the city of Washburn covered 411 acres (167 ha). A total of 160 structures were documented within the coastal zone area.

Washburn's residential area covered 42 acres (16.8 ha) and consisted of two (2) residential types. Over 40 acres (16.4 ha) were classified as single family/duplex, an additional 1.1 acres (.5 ha) were classified as low-rise multi-family. Structures documented included 73 single family/duplex units, 20 garages ([1] associated with multi-family), 19 sheds and (1) multi-family unit.

Commercial land covered 11.8 acres (4.8 ha) of the coastal zone. Nine (9) acres (3.6 ha) and 22 structures were assigned to the type neighborhood business district. An additional 2.9 acres (1.2 ha) and (1) structure were assigned to institutional uses.

Industrial land covered 13.3 acres (5.4 ha), on which (6) structures were located.

Within the city's coastal zone, (4) transportation types were identified on a total of 19.2 acres (7.8 ha). Types identified include 11 acres (4.5 ha - [1] structure) of private marina, .7 acres (.3 ha) of public boat landing, .6 acres (.2 ha) of utility, and 6.9 acres (2.8 ha - [3] structures) of land devoted to sewage treatment.

No extractive uses were observed within Washburn's coastal zone.

Land devoted to agricultural and natural uses covered 281 acres (114 ha) which represents 68% of the total coastal zone area. Within the agricultural and natural category, forest represented nearly 85% (238 acres [97 ha]) of the total area. Other category types identified within the coastal zone include 36 acres (14.7 ha) of active agricultural land, 2.4 acres (1 ha) of open water, .4 acres (.16 ha) of slump zone, and 3.8 acres (1.5 ha) of wetland.

A total of 44 acres (17.9 ha) of open/other land uses were located within the coastal zone. Types included .8 acres (.3 ha) of urban open lot and 43 acres (17.6 ha - 14 structures) of outdoor recreation.

Shoreline modifications included 2,347 feet (715 m) of sea wall, 988 feet (301 m) of revetment, (2) groins and (1) non-flow-through dock.

RESULTS - DOUGLAS COUNTY

Douglas County communities lying within the Lake Superior coastal zone include the townships of Cloverland and Lakeside, and the city of Superior. The area measured within the coastal zone of Douglas County was 3,928 acres (1,591 ha). Over 84% of the county's coastal zone consisted of land cover types of the agricultural and natural lands category. A total of 1,030 structures were located within the county's coastal zone.

Statistical summaries for Douglas County and all communities included in this study are located in the Appendix.[3] Summary data sheets present land use types by area, 1992 structural counts by type, shoreline modification types by length, and a count of shoreline structures by type. Data were collected at the PLSS section level. The section level data sheets are not included in this report.

Residential Land

Within the coastal zone of Douglas County, 904 residential structures were located on 170 acres (69 ha) of residential land. Residential types included 1.4 acres (.6 ha) of low-rise multi-family, 149 acres (60 ha) of single family/duplex and 20 acres (8.2 ha) of mobile homes. Structures identified included (5) low-rise multi-family units. Structures associated with the type single family/duplex included 409 single family/duplex units, 258 detached garages and 76 sheds, while structures associated with the type mobile homes included 110 mobile home units, (1) detached garage and 45 sheds.

Commercial land covered 46 acres (18.6 ha) of the coastal zone. The type neighborhood business district consisted of 36 acres (14.6 ha) and 22 structures. The type institutional use covered 10 acres (4 ha) on which (7) structures were located.

Industrial land within the coastal zone covered 150 acres (61 ha) and included 60 structures.

Eight (8) types of transportation category uses were identified within the county's coastal zone. These included 56 acres (23 ha - [1] structure) of rail transportation, 53 acres (22 ha - [8] structures) of water transportation, 16.2 acres (6.6 ha - [1] structure) of private marina, 3.8 acres (1.5 ha) of public boat landing, 34 acres (14 ha) of highway, 2.3 acres (.9 ha - [3] structures) of communications land, 9.7 acres (3.9 ha - [9] structures) of utility, and 22 acres (8.7 ha - [8] structures) of sewage treatment plant area.

No extractive uses were located within the county's coastal zone.

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[3]Area figures used in the Results discussion reflect totals (not rounded) reported on the original tally sheets. Figures presented on the tally sheets found in the appendix of this report have been rounded to the nearest whole number.

Agricultural and natural category uses covered 3,327 acres (1,348 ha) or nearly 85% of the county's coastal zone. Within this category, forest covered 68% (2,264 acres [917 ha]) of total category area. Other category types included 362 acres (147 ha) of abandoned field, 101 acres (41 ha) of heath, 130 acres (53 ha) of open water, 192 acres (78 ha) of slump zone, and 279 acres (113 ha) of wetland.

Open/other land uses totaled 36 acres (14.8 ha) and consisted of two (2) types. Urban open lot covered 11 acres (4.5 ha). The type outdoor recreation covered 25 acres (10.3 ha) and included (7) structures.

Modifications to the county's shoreline included 19,480 feet (5,939 m) of sea wall, 10,314 feet (3,145 m) of revetment, (3) groins and (3) non-flow-through docks.

Results by Community

Town of Cloverland

The area of Cloverland's coastal zone was measured at 1,082 acres (438 ha). Only three (3) structures were located within the town's coastal zone.

Less than one (1) acre (.8 acres [.34 ha]) of residential land was documented within the coastal zone, all assigned to the type single family/duplex. Associated structures included (1) single family/duplex unit and (1) shed.

No commercial, industrial or extractive land uses were documented within the coastal zone of Cloverland.

Just one type of transportation land was observed within the town's coastal zone. Public boat landing covered 1.8 acres (.7 ha) of area.

Most (99.6%) of Cloverland's coastal zone consists of land use types within the agricultural and natural category. Category types cover 1,078 acres (437 ha) of coastal zone area, of which 946 acres (383 ha) are forest. Other category types located within the coastal zone include 11.1 acres (4.5 ha) of abandoned field, .9 acres (.4 ha) of heath, 16.2 acres (6.6 ha) of open water, 75 acres (31 ha) of slump zone, and 29 acres (11.6 ha) of wetland.

Only one land use type from the category open/other was documented within the town's coastal zone. A total of .7 acres (.3 ha) of land devoted to outdoor recreation was observed. One (1) structure was noted as well.

No evidence of shoreline modification was observed within the town's coastal zone.

Town of Lakeside

The town's coastal zone consisted of 1,043 acres (422 ha), 99% of which was classified as agricultural or natural.

A total of 45 residential structures were located on 8.8 acres (3.6 ha) of residential land. All residential land was of

the type single family/duplex. Structures documented include 36 single family or duplex units, (4) detached garages and (5) sheds.

The township's coastal zone included no commercial, industrial, transportation or extractive category uses.

As stated earlier, land use types within the agricultural and natural category covered 99% of Lakeside's coastal zone. Of total acreage within the agricultural and natural category, forest land represented 84% or 869 acres (352 ha). Other types observed within the coastal zone include .9 acres (.4 ha) of abandoned field, 7.8 acres (3.2 ha) of heath, 27 acres (10.8 ha) of open water, 114 acres (46 ha) of slump zone, and 14.8 acres (6 ha) of wetland.

No land use types of the open/other category were observed within the town's coastal zone.

Shoreline modifications consisted of (1) non-flow-through dock.

City of Superior

A total of 1,803 acres (730 ha) and 982 structures were observed within Superior's coastal zone.

Residential land within the coastal zone consisted of 161 acres (65 ha) and included 857 structures. Five (5) low-rise multi-family structures were located on 1.4 acres (.6 ha) of land. Land devoted to single family/duplex uses covered 139 acres (56 ha). Structures associated with the type single family/duplex included 372 single family or duplex units, 254 detached garages and 70 sheds. Over 20 acres (8.2 ha) of land devoted to mobile home use also were documented. Associated structures included 110 mobile home units, (1) detached garage and 45 sheds.

Commercial land within the coastal zone was measured at 46 acres (18.6 ha). Commercial types included 36 acres (14.6 ha - 22 structures) of neighborhood business district and 10 acres (4 ha - [7] structures) of institutional land.

A total of 150 acres (61 ha) of industrial land was located within the city's coastal zone. Sixty (60) industrial structures were observed.

Transportation land consisted of 195 acres (79 ha) on which 30 structures were located. Observed types within this category included 56 acres (23 ha - [1] structure) of rail transportation, 53 acres (22 ha - [8] structures) of water transportation, 16.2 acres (6.6 ha - [1] structure) of private marina, (2) acres (.8 ha) of public boat landing, 34 acres (14 ha) of highway, 2.3 acres (.9 ha - [3] structures) of communications facilities, 9.7 acres (3.9 ha - [9] structures) of utilities, and 22 acres (8.7 ha - [8] structures) of sewage treatment plant.

No extractive uses were documented within the city's coastal zone.

Land use types of the agricultural and natural category represented 67% of the city's coastal zone area. Documented

types included 350 acres (142 ha) of abandoned field, 448 acres (182 ha) of forest, 92 acres (37 ha) of heath, 87 acres (35 ha) of open water, 2.7 acres (1.1 ha) of slump zone, and 235 acres (95 ha) of wetland.

Two (2) use types were observed within the open/other land use category. Urban open lots covered 11 acres (4.5 ha) while the outdoor recreation type covered 25 acres (10 ha), on which six (6) structures were located.

Shoreline modifications consisted of 19,482 feet (5,939 m) of sea wall and 10,314 feet (3,145 m) of revetment. Additionally, (3) groins and (2) non-flow-through docks were located along the shoreline.

RESULTS - IRON COUNTY

Only the town of Saxon lies within Iron County's coastal zone of Lake Superior.

Statistical summaries for Iron County and all communities included in this study are located in the Appendix.[4] Summary data sheets present land use types by area, 1992 structural counts by type, shoreline modification types by length, and a count of shoreline structures by type. Data were collected at the PLSS section level. The section level data sheets are not included in this report.

In 1992, Saxon's coastal zone covered 857 acres (347 ha), of which only (6) acres (2.3 ha) were residential. A total of 13 residential structures were observed, including 10 residential units, (1) garage and (2) sheds. A total of (.3) acres (.1 ha) of commercial land was observed within the town's coastal zone, while land devoted to transportation - public boat landing, covered 11 acres (4.5 ha). Three (3) structures were tallied on land devoted to transportation. No area of the town's coastal zone was devoted to extractive land uses.

Over 97% (839 acres [340 ha]) of Saxon's coastal zone area was covered by agricultural and natural land uses. Of the total area within these categories, 775 acres (314 ha) or 92% were located within the forest type. The only other coverage with significant acreage was slump zone (59 acres [24 ha]).

Aerial analysis identified 979 feet (299 m) of revetment along Saxon's shoreline, as well as two (2) groins. No sea walls or non-flow-through docks were observed.

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[4]Area figures used in the Results discussion reflect totals (not rounded) reported on the original tally sheets. Figures presented on the tally sheets found in the Appendix of this report have been rounded to the nearest whole number.

REFERENCES

Avery, T.E. and G.L. Berlin, 1985. Interpretation of Aerial Photographs. 4th ed., Brugess Publishing Co., Minneapolis. 554 pp.

Barrett, N.E. and W.A. Niering, 1993. Tidal marsh restoration: trends in vegetation change using a geographic information system. Society for Ecological Restoration. 1(1):18-28.

Befort, W. and J.J. Viliman, 1985. Aerial identification of forest habitats. *Proceedings of the ACSM-ASPRS Annual Convention*, Washington, D.C., Vol. 2, pp. 679-688.

Benton, A.R., Jr., W.W. Snell and C. Clark, 1978. Seasonal aerial photographic mapping of Galveston Island. Coastal Mapping Papers Reprint from Coastal Zone '78, Amer. Soc. Civil Eng., pp. 1205-1222.

Boge, W.E., A.C. Crone and R.J. Ondrejka, 1992. Primary data acquisition - state of the art review. *Photogrammetric Engineering and Remote Sensing*, 58(8):1077-10.

Carlson, H., L.M. Andrews and C.W. Threinen, 1977. *Surface Water Resources of Oconto County*. Wisconsin Department of Natural Resources, Madison, Wisconsin.

Ciciarelli, J.A., 1991. Practical Guide to Aerial Photography. Van Nostrand Reinhold, New York, 261 pp.

Dresen, M. and M.E. Vollbrecht, 1986. Wisconsin's shoreland zoning program: design and direction. *The Michigan Riparian*.

Eastman-Kodak, 1974. *Photography from Light Planes and Helicopters*. Pub. No. M-5, Rochester, N.Y., 25 p.

Evans, B.M. and L. Mata, 1984. Acquisition of 35mm oblique photographs for stereoscopic analysis and measurement. *Photogrammetric Engineering & Remote Sensing*, 50(11):1581-1590.

Ferguson, R.L., L.L. Wood and D.B. Graham, 1993. Monitoring spacial change in seagrass habitat with aerial photography. *Photogrammetric Engineering and Remote Sensing*, 59(6):1033-1038.

Fleming, J. and R.G. Dixon, 1981. *Basic Guide to Small-Format Hand-Held Oblique Aerial Photography*. Canadian Centre for Remote Sensing, Ottawa, Ontario, 81 p.

Hagen, G.F. and J.L. Smith, 1986. Predicting tree groundline diameter from crown measurements made on 35mm aerial photography. *Photogrammetric Engineering & Remote Sensing*, 52(5):687-690.

Heer, R.C. and J.L. Smith, 1986. Estimation of density in young pine plantations using 35mm aerial photography. *Proceedings of the ACSM-ASPRS Annual Convention*, Washington, D.C., Vol. 5, pp. 80-84.

Hill, J.M., D.L. Evans and J. Blackman, 1985. Development of a permit geographic information system for coastal zone management. *Proceedings of the ACSM-ASPRS Annual Convention*, Washington, D.C., Vol. 1, pp. 284-293.

Hinckley, T.K. and J.W. Walker, 1993. Obtaining and using low-altitude/large-scale imagery. *Photogrammetric Engineering and Remote Sensing*, 59(3):310-318.

International Joint Commission, Committee 2, 1993. Detailed Site Study - Berrien County, Michigan: Final Report, 75 pp.

International Joint Commission, 1993. Great Lakes Water Level Reference Study. Working Committee 2. Land Use and Shoreline Management Task Group Report, 99 pp.

Kim, K. and S. Ventura, 1993. Large-scale modeling of urban nonpoint source pollution using a geographic information system. *Photogrammetric Engineering and Remote Sensing*, 59(10):1539-1544.

Lo, C.P. and W.E. Noble, 1990. Detailed urban land-use and land-cover mapping using large format camera photographs: an evaluation. *Photogrammetric Engineering and Remote Sensing*, 56(2):197-206.

Lyon, J.G. and R.G. Greene, 1992. Use of aerial photographs to measure the historical areal extent of Lake Erie coastal wetlands. *Photogrammetric Engineering and Remote Sensing*, 58(9):1355-1360.

MacConnell, W.F., 1975. Remote Sensing 20 years of change in Massachusetts: 1952-1972. Mass. Agric. Exp. Sta. Bulletin 630, Amherst, Mass., 79 pp.

Marsh, S.E., J.L. Welsh and C.F. Hutchinson, 1990. Development of an agricultural land-use GIS for surveyed derived from multispatial video and photographic data. *Photogrammetric Engineering and Remote Sensing*, 56(3):359-363.

McCarthy, J., C.E. Olson and J.A. Witter, 1982. Evaluation of spruce-fir forests using small-format photographs. *Photogrammetric Engineering & Remote Sensing*, 48(5):771-778.

Niedzwiedz, W.R., 1990. Assessing permit compliance in residential areas using color 35mm aerial photography. *Photogrammetric Engineering & Remote Sensing*, 56(2):211-224.

Niedzwiedz, W.R. and S.S. Batie, 1984. An assessment of urban development into coastal wetlands using historical aerial photography: a case study. *Environmental Management*, 8(3):205-214.

Norton, D.J., J. Organ and T. Litwin, 1985. Covertype classification and mapping on Long Island's National Wildlife Refuge. *Proceedings of the ACSM-ASPRS Annual Convention*, Washington, D.C., Vol. 2, pp. 585-594.

Paine, D.P. and R.J. McCadden, 1988. Simplified forest inventory using large-scale 70mm photography and tariff tables. *Photogrammetric Engineering & Remote Sensing*, 54(10):1423-1427.

Roberts, A. and L. Griswold, 1986. Practical photogrammetry from 35mm aerial photography. *Photogrammetric Engineering & Remote Sensing*, 52(4):501-508.

Scarpace, F.L., B.K. Quirk, R.W. Kiefer and S.L. Wynn, 1981. Wetland mapping from digitized aerial photography. *Photogrammetric Engineering and Remote Sensing*, 47(6):829-838.

Scherz, J.P. and J.F. Van Domelsen, 1973. Lake Superior Water Quality Near Duluth from Analysis of Aerial Photos and ERTS Imagery, *Remote Sensing and Water Resources Management, American Water Resources Association*, Proceedings, No. 17.

Shafer, R. and S. Degler, 1986. 35mm photography: an inexpensive remote sensing tool. *Photogrammetric Engineering & Remote Sensing*, 52(6):833-837.

Smith, J.T., ed., 1968. Manual of Color Aerial Photography. American Society of Photogrammetry, Falls Church, VA., 550 pp.

U.S. Army Corps of Engineers, 1978. Monthly Bulletin of Lake Levels for the Great Lakes. April. Dept. of the Army, Detroit, MI. pp.4

U.S. Army Corps of Engineers, 1992. Monthly Bulletin of Lake Levels for the Great Lakes. May. Dept. of the Army, Detroit, MI. pp.4

Walker, J.W., 1985. Ultra-light reconnaissance, another tool. *Proceedings of the ACSM-ASPRS Annual Convention*, Washington, D.C., Vol. 1, pp. 371-380.

Welch, R., T.R. Jordan and S.S. Fung, 1985. Photogrammetry: A revolutionary solution to the assessment of ephemeral gully erosion. *Proceedings of the ACSM-ASPRS Annual Convention*, Washington, D.C., Vol. 2, pp. 873-874.

Welch, R., M. Remillard and J. Alberts, 1992. Integration of GPS, remote sensing and GIS techniques for coastal resource management. *Photogrammetric Engineering and Remote Sensing*, 58(11):1571-1578.

APPENDIX I

Ashland County Data Sheets

Lake Superior Coastal Development Inventory Project:
1992

County Summary Data Sheet

County: Ashland
Coastal Civil Jurisdiction included in summary (in alphabetical order).

City of Ashland
Town of Sanborn

LAND USE CATEGORIES

	# of structures	Area Acres	Hectares
11 Residential			
111 Res. units			
garages			
sheds			
112 Res. units			
garages			
sheds			
113 Res. units	417	199	81
garages	174		
sheds	108		
barns			
115 Res. units	7	2	1
garages			
sheds	4		
Subtotal	710	201	81
12 Commercial			
121 Central Business Dist	99	28	11
122 Shopping Center/Mall			
124 Neighborhood Business Dist	118	85	34
126 Institutional	8	11	5
Subtotal	225	124	50
13 Industrial			
138 Industrial Park	27	57	23

	# of structures	Area Acres	Hectares
14 Transportation			
141 Air Transportation			
142 Rail Transportation		10	4
143 Water Transportation		3	1
143.1 Private Marina	14	10	4
143.2 Public Boat Landing		2	1
144 Highways		33	13
145 Communications	5	2	1
146 Utilities	18	28	11
147 Sewage Treatment Plant	2	6	3
148 Landfill		5	2
Subtotal	39	99	40
17 Extractive			
171 Open Pit			
172 Underground			
173 Well			
179 Other Extractive			
Subtotal			
18 Agricultural and Natural			
181 AF Abandoned Field	1	103	42
182 AG Agriculture Active			
183 F Forest		1333	540
184 H Heath		246	100
185 OW Open Water		226	91
186 RL Rock Ledge			
187 SL Slump Zone		24	10
188 WT Wetland		774	314
Subtotal	1	2705	1096
19 Open Land, Other			
191 Outdoor-Public Assembly	2	3	1
192 Urban Open Lots		5	2
193 Outdoor Recreation	11	28	11
194 Cemeteries			
Subtotal	13	35	14
Total Acres			3222
Total Hectares			1305

Shoreline Modifications		Linear Feet	Meters
195 Sea Walls		5375	1639
196 Revetments		13343	4068
197 Groins	# of Groins	7	
198 Dock Non-Flow-Through	# of Docks	3	

Lake Superior Coastal Development Inventory Project:
1992

Civil Jurisdiction
Summary Data Sheet

County: Ashland
Township, Village or City name: City of Ashland
PLSS section data sheets included in summary (give full description):

T47N R4W	SEC 5	T48N R4W	SEC 23
	SEC 6		SEC 26
			SEC 27
			SEC 28
			SEC 32
			SEC 33
			SEC 34

LAND USE CATEGORIES

	# of structures	Area Acres	Hectares
11 Residential			
111 Res. units			
garages			
sheds			
112 Res. units			
garages			
sheds			
113 Res. units	337	141	57
garages	159		
sheds	74		
barns			
115 Res. units	7	2	1
garages			
sheds	4		
Subtotal	581	143	58
12 Commercial			
121 Central Business Dist	99	28	11
122 Shopping Center/Mall			
124 Neighborhood Business Dist	118	85	34
126 Institutional	8	11	5
Subtotal	225	124	50
13 Industrial			
138 Industrial Park	27	57	23

	# of structures	Area Acres	Hectares
14 Transportation			
141 Air Transportation			
142 Rail Transportation		10	4
143 Water Transportation		3	1
143.1 Private Marina	14	10	4
143.2 Public Boat Landing		1	<1
144 Highways		33	13
145 Communications			
146 Utilities	18	28	11
147 Sewage Treatment Plant	2	6	3
148 Landfill		5	2
Subtotal	34	96	39
17 Extractive			
171 Open Pit			
172 Underground			
173 Well			
179 Other Extractive			
Subtotal			
18 Agricultural and Natural			
181 AF Abandoned Field	1	79	32
182 AG Agriculture Active			
183 F Forest		147	59
184 H Heath		<1	<1
185 OW Open Water		15	6
186 RL Rock Ledge			
187 SL Slump Zone		1	<1
188 WT Wetland		23	9
Subtotal	1	265	107
19 Open Land, Other			
191 Outdoor-Public Assembly	2	3	1
192 Urban Open Lots		5	2
193 Outdoor Recreation	10	27	11
194 Cemeteries			
Subtotal	12	35	14
Total Acres			719
Total Hectares			291

Shoreline Modifications	Linear Feet	Meters
195 Sea Walls	4453	1358
196 Revetments	11316	3450
197 Groins	# of Groins	6
198 Dock Non-Flow-Through	# of Docks	3

Lake Superior Coastal Development Inventory Project:
1992

Civil Jurisdiction
Summary Data Sheet

County: Ashland
Township, Village or City name: Town of Sanborn
PLSS section data sheets included in summary (give full description):

T47N R2W SEC 1	T48N R3W SEC 1	SEC 19	T48N R4W SEC 24
T48N R2W SEC 7	SEC 2	SEC 20	T49N R3W SEC 27
SEC 17	SEC 3		SEC 28
SEC 18	SEC 4		SEC 34
SEC 20	SEC 5		SEC 35
SEC 21	SEC 9		
SEC 26	SEC 12		
SEC 27	SEC 16		
SEC 35	SEC 17		
SEC 36	SEC 18		

LAND USE CATEGORIES

	# of structures	Area Acres	Hectares
11 Residential			
111 Res. units			
garages			
sheds			
112 Res. units			
garages			
sheds			
113 Res. units	80	58	23
garages	15		
sheds	34		
barns			
115 Res. units			
garages			
sheds			
Subtotal	129	58	23
12 Commercial			
121 Central Business Dist			
122 Shopping Center/Mall			
124 Neighborhood Business Dist			
126 Institutional			
Subtotal			
13 Industrial			
138 Industrial Park			

	# of structures	Area Acres	Hectares
14 Transportation			
141 Air Transportation			
142 Rail Transportation			
143 Water Transportation			
143.1 Private Marina			
143.2 Public Boat Landing		1	<1
144 Highways			
145 Communications	5	2	1
146 Utilities			
147 Sewage Treatment Plant			
148 Landfill			
Subtotal	5	3	1
17 Extractive			
171 Open Pit			
172 Underground			
173 Well			
179 Other Extractive			
Subtotal			
18 Agricultural and Natural			
181 AF Abandoned Field		24	10
182 AG Agriculture Active			
183 F Forest		1187	481
184 H Heath		246	100
185 OW Open Water		211	85
186 RL Rock Ledge			
187 SL Slump Zone		23	9
188 WT Wetland		751	304
Subtotal		2441	988
19 Open Land, Other			
191 Outdoor-Public Assembly			
192 Urban Open Lots			
193 Outdoor Recreation	1	1	<1
194 Cemeteries			
Subtotal	1	1	<1
Total Acres			2502
Total Hectares			1013

Shoreline Modifications	Linear Feet	Meters
195 Sea Walls	922	281
196 Revetments	2027	618
197 Groins	# of Groins	1
198 Dock Non-Flow-Through	# of Docks	

APPENDIX II

Bayfield County Data Sheets

Lake Superior Coastal Development Inventory Project:
1992

County Summary Data Sheet

County: Bayfield
Coastal Civil Jurisdiction included in summary (in alphabetical order).

Town of Barksdale	Town of Eileen
City of Bayfield	Town of Orienta
Town of Bayfield	Town of Port Wing
Town of Bayview	City of Russell
Town of Bell	City of Washburn
Town of Clover	

LAND USE CATEGORIES

	# of structures	Area Acres	Hectares
11 Residential			
111 Res. units			
garages			
sheds			
112 Res. units	7	4	2
garages	1		
sheds			
113 Res. units	804	378	153
garages	202		
sheds	275		
barns	6		
115 Res. units	9	1	1
garages			
sheds			
Subtotal	1304	384	156
12 Commercial			
121 Central Business Dist			
122 Shopping Center/Mall			
124 Neighborhood Business Dist	135	65	26
126 Institutional	8	8	3
Subtotal	143	73	30
13 Industrial			
138 Industrial Park	7	19	8

	# of structures	Area Acres	Hectares
14 Transportation			
141 Air Transportation			
142 Rail Transportation			
143 Water Transportation			
143.1 Private Marina	42	78	32
143.2 Public Boat Landing	3	4	2
144 Highways		20	8
145 Communications			
146 Utilities		1	<1
147 Sewage Treatment Plant	4	10	4
148 Landfill			
Subtotal	49	112	45
17 Extractive			
171 Open Pit			
172 Underground			
173 Well			
179 Other Extractive			
Subtotal			
18 Agricultural and Natural			
181 AF Abandoned Field	2	279	113
182 AG Agriculture Active	1	85	34
183 F Forest		7750	3139
184 H Heath		67	27
185 OW Open Water		210	85
186 RL Rock Ledge			
187 SL Slump Zone		92	37
188 WT Wetland		666	270
Subtotal	3	9148	3705
19 Open Land, Other			
191 Outdoor-Public Assembly			
192 Urban Open Lots		4	2
193 Outdoor Recreation	24	72	29
194 Cemeteries		1	<1
Subtotal	24	77	31
Total Acres		9813	
Total Hectares		3974	

Shoreline Modifications		Linear Feet	Meters
195 Sea Walls		6914	2108
196 Revetments		11623	3544
197 Groins	# of Groins	10	
198 Dock Non-Flow-Through	# of Docks	5	

Lake Superior Coastal Development Inventory Project:
1992

Civil Jurisdiction
Summary Data Sheet

County: Bayfield
Township, Village or City name: Town of Barksdale
PLSS section data sheets included in summary (give full description):

T48N R4W	SEC 7	T48N R5W	SEC 24
	SEC 18		SEC 25
	SEC 19		SEC 26
			SEC 35
			SEC 36

LAND USE CATEGORIES

	# of structures	Area Acres	Area Hectares
11 Residential			
111 Res. units			
garages			
sheds			
112 Res. units			
garages			
sheds			
113 Res. units	92	58	24
garages	31		
sheds	40		
barns	1		
115 Res. units			
garages			
sheds			
Subtotal	164	58	24
12 Commercial			
121 Central Business Dist			
122 Shopping Center/Mall			
124 Neighborhood Business Dist		<1	<1
126 Institutional			
Subtotal		<1	<1
13 Industrial			
138 Industrial Park			

	# of structures	Area Acres	Hectares
14 Transportation			
141 Air Transportation			
142 Rail Transportation			
143 Water Transportation			
143.1 Private Marina			
143.2 Public Boat Landing		1	<1
144 Highways		7	3
145 Communications			
146 Utilities		<1	<1
147 Sewage Treatment Plant			
148 Landfill			
Subtotal		8	3
17 Extractive			
171 Open Pit			
172 Underground			
173 Well			
179 Other Extractive			
Subtotal			
18 Agricultural and Natural			
181 AF Abandoned Field		50	20
182 AG Agriculture Active		4	2
183 F Forest		491	199
184 H Heath		<1	<1
185 OW Open Water		11	4
186 RL Rock Ledge			
187 SL Slump Zone		1	<1
188 WT Wetland		62	25
Subtotal		620	251
19 Open Land, Other			
191 Outdoor-Public Assembly			
192 Urban Open Lots			
193 Outdoor Recreation			
194 Cemeteries			
Subtotal			
Total Acres		686	
Total Hectares		278	

Shoreline Modifications	Linear Feet	Meters
195 Sea Walls	124	38
196 Revetments	2252	687
197 Groins	# of Groins 1	
198 Dock Non-Flow-Through	# of Docks	

Lake Superior Coastal Development Inventory Project:
1992

Civil Jurisdiction
Summary Data Sheet

County: Bayfield
Township, Village or City name: City of Bayfield
PLSS section data sheets included in summary (give full description):

T50N R4W SEC 13
SEC 14

LAND USE CATEGORIES

	# of structures	Area Acres	Hectares
11 Residential			
111 Res. units			
garages			
sheds			
112 Res. units			
garages			
sheds			
113 Res. units	127	52	21
garages	31		
sheds	29		
barns			
115 Res. units	9	1	<1
garages			
sheds			
Subtotal	187	53	21
12 Commercial			
121 Central Business Dist			
122 Shopping Center/Mall			
124 Neighborhood Business Dist	69	28	11
126 Institutional	6	4	1
Subtotal	75	32	13
13 Industrial			
138 Industrial Park			

	# of structures	Area Acres	Area Hectares
14 Transportation			
141 Air Transportation			
142 Rail Transportation			
143 Water Transportation			
143.1 Private Marina	26	27	11
143.2 Public Boat Landing			
144 Highways			
145 Communications			
146 Utilities		<1	<1
147 Sewage Treatment Plant			
148 Landfill			
Subtotal	26	27	11
17 Extractive			
171 Open Pit			
172 Underground			
173 Well			
179 Other Extractive			
Subtotal			
18 Agricultural and Natural			
181 AF Abandoned Field		7	3
182 AG Agriculture Active			
183 F Forest		30	12
184 H Heath			
185 OW Open Water		<1	<1
186 RL Rock Ledge			
187 SL Slump Zone			
188 WT Wetland			
Subtotal		37	15
19 Open Land, Other			
191 Outdoor-Public Assembly			
192 Urban Open Lots		3	1
193 Outdoor Recreation	1	1	1
194 Cemeteries			
Subtotal	1	5	2
Total Acres			153
Total Hectares			62

Shoreline Modifications	Linear Feet	Linear Meters
195 Sea Walls	652	199
196 Revetments	3272	998
197 Groins	# of Groins	
198 Dock Non-Flow-Through	# of Docks	

Lake Superior Coastal Development Inventory Project:
1992

Civil Jurisdiction
Summary Data Sheet

County: Bayfield
Township, Village or City name: Town of Bayfield
PLSS section data sheets included in summary (give full description):

T50N R3W	SEC 6	T51N R5W	SEC 1	T52N R5W	SEC 34
	SEC 7		SEC 3		SEC 35
T50N R4W	SEC 12		SEC 4		SEC 36
	SEC 14		SEC 7		
	SEC 22		SEC 8		
	SEC 23		SEC 9		
	SEC 27		SEC 18		
	SEC 28		SEC 19		

LAND USE CATEGORIES

	# of structures	Area Acres	Hectares
11 Residential			
111 Res. units			
garages			
sheds			
112 Res. units			
garages			
sheds			
113 Res. units	56	35	14
garages	14		
sheds	19		
barns			
115 Res. units			
garages			
sheds			
Subtotal	89	35	14
12 Commercial			
121 Central Business Dist			
122 Shopping Center/Mall			
124 Neighborhood Business Dist	6	5	2
126 Institutional	1	2	1
Subtotal	7	7	3
13 Industrial			
138 Industrial Park			

	# of structures	Area Acres	Hectares
14 Transportation			
141 Air Transportation			
142 Rail Transportation			
143 Water Transportation			
143.1 Private Marina	3	17	7
143.2 Public Boat Landing			
144 Highways			
145 Communications			
146 Utilities			
147 Sewage Treatment Plant	1	3	1
148 Landfill			
Subtotal	4	20	8
17 Extractive			
171 Open Pit			
172 Underground			
173 Well			
179 Other Extractive			
Subtotal			
18 Agricultural and Natural			
181 AF Abandoned Field		24	10
182 AG Agriculture Active		6	2
183 F Forest		1551	628
184 H Heath		1	<1
185 OW Open Water		17	7
186 RL Rock Ledge			
187 SL Slump Zone		4	2
188 WT Wetland		68	27
Subtotal		1669	676
19 Open Land, Other			
191 Outdoor-Public Assembly			
192 Urban Open Lots			
193 Outdoor Recreation			
194 Cemeteries			
Subtotal			

Total Acres	1731
Total Hectares	701

Shoreline Modifications	Linear Feet	Meters
195 Sea Walls	1055	322
196 Revetments		
197 Groins	# of Groins	
198 Dock Non-Flow-Through	# of Docks 1	

Lake Superior Coastal Development Inventory Project:
1992

Civil Jurisdiction
Summary Data Sheet

County: Bayfield
Township, Village or City name: Town of Bayview
PLSS section data sheets included in summary (give full description):

T49N R4W	SEC 4	T50N R4W	SEC 33
	SEC 5		SEC 34
	SEC 8		
	SEC 9		
	SEC 16		
	SEC 21		
	SEC 22		
	SEC 27		
	SEC 28		

LAND USE CATEGORIES

	# of structures	Area Acres	Hectares
11 Residential			
111 Res. units			
garages			
sheds			
112 Res. units			
garages			
sheds			
113 Res. units	60	26	11
garages	25		
sheds	18		
barns			
115 Res. units			
garages			
sheds			
Subtotal	103	26	11
12 Commercial			
121 Central Business Dist			
122 Shopping Center/Mall			
124 Neighborhood Business Dist			
126 Institutional			
Subtotal			
13 Industrial			
138 Industrial Park			

	# of structures	Area Acres	Hectares
14 Transportation			
141 Air Transportation			
142 Rail Transportation			
143 Water Transportation			
143.1 Private Marina			
143.2 Public Boat Landing	1	<1	<1
144 Highways			
145 Communications			
146 Utilities			
147 Sewage Treatment Plant			
148 Landfill			
Subtotal	1	<1	<1
17 Extractive			
171 Open Pit			
172 Underground			
173 Well			
179 Other Extractive			
Subtotal			
18 Agricultural and Natural			
181 AF Abandoned Field		28	11
182 AG Agriculture Active		2	1
183 F Forest		678	275
184 H Heath		10	4
185 OW Open Water		9	4
186 RL Rock Ledge			
187 SL Slump Zone		<1	<1
188 WT Wetland		91	37
Subtotal		819	332
19 Open Land, Other			
191 Outdoor-Public Assembly			
192 Urban Open Lots			
193 Outdoor Recreation			
194 Cemeteries			
Subtotal			
Total Acres		845	
Total Hectares		342	

Shoreline Modifications	Linear Feet	Meters
195 Sea Walls	246	75
196 Revetments	70	21
197 Groins	# of Groins 3	
198 Dock Non-Flow-Through	# of Docks	

Lake Superior Coastal Development Inventory Project:
1992

Civil Jurisdiction
Summary Data Sheet

County: Bayfield
Township, Village or City name: Town of Bell
PLSS section data sheets included in summary (give full description):

T50N R6W SEC 6	T51N R6W SEC 22
	SEC 23
	SEC 24
	SEC 27
	SEC 29
	SEC 31
	SEC 32
	SEC 33
	SEC 34

LAND USE CATEGORIES

	# of structures	Area Acres	Hectares
11 Residential			
111 Res. units			
garages			
sheds			
112 Res. units			
garages			
sheds			
113 Res. units	152	61	25
garages	38		
sheds	40		
barns			
115 Res. units			
garages			
sheds			
Subtotal	230	61	25
12 Commercial			
121 Central Business Dist			
122 Shopping Center/Mall			
124 Neighborhood Business Dist	8	3	1
126 Institutional			
Subtotal	8	3	1
13 Industrial			
138 Industrial Park			

	# of structures	Area Acres	Hectares
14 Transportation			
141 Air Transportation			
142 Rail Transportation			
143 Water Transportation			
143.1 Private Marina	10	11	5
143.2 Public Boat Landing			
144 Highways			
145 Communications			
146 Utilities			
147 Sewage Treatment Plant			
148 Landfill			
Subtotal	10	11	5
17 Extractive			
171 Open Pit			
172 Underground			
173 Well			
179 Other Extractive			
Subtotal			
18 Agricultural and Natural			
181 AF Abandoned Field		13	5
182 AG Agriculture Active		12	5
183 F Forest		916	371
184 H Heath		37	15
185 OW Open Water		12	5
186 RL Rock Ledge			
187 SL Slump Zone		7	3
188 WT Wetland		55	22
Subtotal		1052	426
19 Open Land, Other			
191 Outdoor-Public Assembly			
192 Urban Open Lots			
193 Outdoor Recreation	1	1	<1
194 Cemeteries			
Subtotal	1	1	<1
Total Acres			1128
Total Hectares			457

Shoreline Modifications	Linear Feet	Meters
195 Sea Walls		
196 Revetments		
197 Groins	# of Groins 1	
198 Dock Non-Flow-Through	# of Docks 1	

Lake Superior Coastal Development Inventory Project:
1992

Civil Jurisdiction
Summary Data Sheet

County: Bayfield
Township, Village or City name: Town of Clover
PLSS section data sheets included in summary (give full description):

T50N R7W	SEC 1	T51N R7W	SEC 24
	SEC 4		SEC 25
	SEC 5		SEC 26
	SEC 6		SEC 27
	SEC 7		SEC 33
	SEC 8		SEC 34
			SEC 35
			SEC 36

LAND USE CATEGORIES

	# of structures	Area Acres	Hectares
11 Residential			
111 Res. units			
garages			
sheds			
112 Res. units			
garages			
sheds			
113 Res. units	97	65	26
garages	24		
sheds	60		
barns	4		
115 Res. units			
garages			
sheds			
Subtotal	185	65	26
12 Commercial			
121 Central Business Dist			
122 Shopping Center/Mall			
124 Neighborhood Business Dist	11	3	1
126 Institutional			
Subtotal	11	3	1
13 Industrial			
138 Industrial Park			

	# of structures	Area Acres	Hectares
14 Transportation			
141 Air Transportation			
142 Rail Transportation			
143 Water Transportation			
143.1 Private Marina			
143.2 Public Boat Landing		2	1
144 Highways			
145 Communications			
146 Utilities			
147 Sewage Treatment Plant			
148 Landfill			
Subtotal		2	1
17 Extractive			
171 Open Pit			
172 Underground			
173 Well			
179 Other Extractive			
Subtotal			
18 Agricultural and Natural			
181 AF Abandoned Field	1	84	34
182 AG Agriculture Active	1	19	8
183 F Forest		770	312
184 H Heath		2	1
185 OW Open Water		77	31
186 RL Rock Ledge			
187 SL Slump Zone		33	13
188 WT Wetland		173	70
Subtotal	2	1157	469
19 Open Land, Other			
191 Outdoor-Public Assembly			
192 Urban Open Lots			
193 Outdoor Recreation	2	5	2
194 Cemeteries			
Subtotal	2	5	2
Total Acres		1231	
Total Hectares		499	

Shoreline Modifications	Linear Feet	Meters
195 Sea Walls	45	14
196 Revetments	1162	354
197 Groins	# of Groins 2	
198 Dock Non-Flow-Through	# of Docks	

Lake Superior Coastal Development Inventory Project:
1992

Civil Jurisdiction
Summary Data Sheet

County: Bayfield
Township, Village or City name: Town of Eileen
PLSS section data sheets included in summary (give full description):

T47N R5W SEC 1

LAND USE CATEGORIES

	# of structures	Area Acres	Hectares
11 Residential			
111 Res. units			
garages			
sheds			
112 Res. units			
garages			
sheds			
113 Res. units	2	2	1
garages			
sheds			
barns			
115 Res. units			
garages			
sheds			
Subtotal	2	2	1
12 Commercial			
121 Central Business Dist			
122 Shopping Center/Mall			
124 Neighborhood Business Dist	4	4	1
126 Institutional			
Subtotal	4	4	1
13 Industrial			
138 Industrial Park			

	# of structures	Area Acres	Hectares
14 Transportation			
141 Air Transportation			
142 Rail Transportation			
143 Water Transportation			
143.1 Private Marina			
143.2 Public Boat Landing			
144 Highways		12	5
145 Communications			
146 Utilities			
147 Sewage Treatment Plant			
148 Landfill			
Subtotal		12	5
17 Extractive			
171 Open Pit			
172 Underground			
173 Well			
179 Other Extractive			
Subtotal			
18 Agricultural and Natural			
181 AF Abandoned Field		<1	<1
182 AG Agriculture Active			
183 F Forest		10	4
184 H Heath			
185 OW Open Water		30	12
186 RL Rock Ledge			
187 SL Slump Zone			
188 WT Wetland		54	22
Subtotal		94	38
19 Open Land, Other			
191 Outdoor-Public Assembly			
192 Urban Open Lots			
193 Outdoor Recreation			
194 Cemeteries			
Subtotal			
Total Acres			112
Total Hectares			45

Shoreline Modifications	Linear Feet	Meters
195 Sea Walls		
196 Revetments	2244	684
197 Groins	# of Groins	
198 Dock Non-Flow-Through	# of Docks	

Lake Superior Coastal Development Inventory Project:
1992

Civil Jurisdiction
Summary Data Sheet

County: Bayfield
Township, Village or City name: Town of Orienta
PLSS section data sheets included in summary (give full description):

T49N R9W	SEC 4	T50N R9W	SEC 25
	SEC 5		SEC 33
	SEC 6		SEC 34
			SEC 35
			SEC 36

LAND USE CATEGORIES

	# of structures	Area Acres	Area Hectares
11 Residential			
111 Res. units			
garages			
sheds			
112 Res. units			
garages			
sheds			
113 Res. units	34	17	7
garages	7		
sheds	20		
barns			
115 Res. units			
garages			
sheds			
Subtotal	61	17	7
12 Commercial			
121 Central Business Dist			
122 Shopping Center/Mall			
124 Neighborhood Business Dist	4	4	2
126 Institutional			
Subtotal	4	4	2
13 Industrial			
138 Industrial Park			

	# of structures	Area Acres	Hectares
14 Transportation			
141 Air Transportation			
142 Rail Transportation			
143 Water Transportation			
143.1 Private Marina			
143.2 Public Boat Landing			
144 Highways			
145 Communications			
146 Utilities			
147 Sewage Treatment Plant			
148 Landfill			
Subtotal			
17 Extractive			
171 Open Pit			
172 Underground			
173 Well			
179 Other Extractive			
Subtotal			
18 Agricultural and Natural			
181 AF Abandoned Field		39	16
182 AG Agriculture Active			
183 F Forest		625	253
184 H Heath		1	<1
185 OW Open Water		12	5
186 RL Rock Ledge			
187 SL Slump Zone		16	7
188 WT Wetland		13	5
Subtotal		705	286
19 Open Land, Other			
191 Outdoor-Public Assembly			
192 Urban Open Lots			
193 Outdoor Recreation	2	3	1
194 Cemeteries			
Subtotal	2	3	1
Total Acres			729
Total Hectares			295

Shoreline Modifications	Linear Feet	Meters
195 Sea Walls	195	60
196 Revetments	1096	334
197 Groins	# of Groins	
198 Dock Non-Flow-Through	# of Docks	

Lake Superior Coastal Development Inventory Project:
1992

Civil Jurisdiction
Summary Data Sheet

County: Bayfield
Township, Village or City name: Town of Port Wing
PLSS section data sheets included in summary (give full description):

T50N R8W SEC 11
SEC 12
SEC 14
SEC 15
SEC 19
SEC 20
SEC 21
SEC 22
SEC 30

LAND USE CATEGORIES

	# of structures	Area Acres	Hectares
11 Residential			
111 Res. units			
garages			
sheds			
112 Res. units			
garages			
sheds			
113 Res. units	27	19	8
garages	4		
sheds	13		
barns	1		
115 Res. units			
garages			
sheds			
Subtotal	45	19	8
12 Commercial			
121 Central Business Dist			
122 Shopping Center/Mall			
124 Neighborhood Business Dist	2	1	<1
126 Institutional			
Subtotal	2	1	<1
13 Industrial			
138 Industrial Park			

	# of structures	Area Acres	Hectares
14 Transportation			
141 Air Transportation			
142 Rail Transportation			
143 Water Transportation			
143.1 Private Marina		3	1
143.2 Public Boat Landing	2	2	1
144 Highways			
145 Communications			
146 Utilities			
147 Sewage Treatment Plant			
148 Landfill			
Subtotal	2	5	2
17 Extractive			
171 Open Pit			
172 Underground			
173 Well			
179 Other Extractive			
Subtotal			
18 Agricultural and Natural			
181 AF Abandoned Field	1	18	7
182 AG Agriculture Active		5	2
183 F Forest		647	262
184 H Heath		13	5
185 OW Open Water		32	13
186 RL Rock Ledge			
187 SL Slump Zone		30	12
188 WT Wetland		84	34
Subtotal	1	828	335
19 Open Land, Other			
191 Outdoor-Public Assembly			
192 Urban Open Lots			
193 Outdoor Recreation	1	4	2
194 Cemeteries			
Subtotal	1	4	2
Total Acres			857
Total Hectares			347

Shoreline Modifications	Linear Feet	Meters
195 Sea Walls	510	155
196 Revetments		
197 Groins	# of Groins	1
198 Dock Non-Flow-Through	# of Docks	1

Lake Superior Coastal Development Inventory Project:
1992

Civil Jurisdiction
Summary Data Sheet

County: Bayfield
Township, Village or City name: Town of Russell
PLSS section data sheets included in summary (give full description):

T51N R3W	SEC 6	T51N R4W	SEC 1
	SEC 7		SEC 2
	SEC 8	T52N R3W	SEC 31
	SEC 16	T52N R4W	SEC 21
	SEC 17		SEC 22
	SEC 20		SEC 26
	SEC 21		SEC 27
	SEC 29		SEC 28
	SEC 30		SEC 35
	SEC 31		SEC 36

LAND USE CATEGORIES

	# of structures	Area Acres	Area Hectares
11 Residential			
111 Res. units			
garages			
sheds			
112 Res. units	6	3	1
garages			
sheds			
113 Res. units	84	40	16
garages	9		
sheds	17		
barns			
115 Res. units			
garages			
sheds			
Subtotal	116	44	18
12 Commercial			
121 Central Business Dist			
122 Shopping Center/Mall			
124 Neighborhood Business Dist	9	8	3
126 Institutional			
Subtotal	9	8	3
13 Industrial			
138 Industrial Park	1	5	2

	# of structures	Area Acres	Hectares
14 Transportation			
141 Air Transportation			
142 Rail Transportation			
143 Water Transportation			
143.1 Private Marina	2	7	3
143.2 Public Boat Landing			
144 Highways			
145 Communications			
146 Utilities			
147 Sewage Treatment Plant			
148 Landfill			
Subtotal	2	7	3
17 Extractive			
171 Open Pit			
172 Underground			
173 Well			
179 Other Extractive			
Subtotal			
18 Agricultural and Natural			
181 AF Abandoned Field		16	6
182 AG Agriculture Active			
183 F Forest		1794	727
184 H Heath		2	1
185 OW Open Water		9	4
186 RL Rock Ledge			
187 SL Slump Zone		1	<1
188 WT Wetland		65	26
Subtotal		1886	764
19 Open Land, Other			
191 Outdoor-Public Assembly			
192 Urban Open Lots			
193 Outdoor Recreation	3	15	6
194 Cemeteries		1	<1
Subtotal	3	15	6
		Total Acres	1966
		Total Hectares	796

Shoreline Modifications	Linear Feet	Meters
195 Sea Walls	1739	530
196 Revetments	539	164
197 Groins	# of Groins	
198 Dock Non-Flow-Through	# of Docks 1	

Lake Superior Coastal Development Inventory Project:
1992

Civil Jurisdiction
Summary Data Sheet

County: Bayfield
Township, Village or City name: City of Washburn
PLSS section data sheets included in summary (give full description):

T48N R4W	SEC 4	T49N R4W	SEC 32
	SEC 5		SEC 33
	SEC 6		SEC 34

LAND USE CATEGORIES

	# of structures	Area Acres	Area Hectares
11 Residential			
111 Res. units			
garages			
sheds			
112 Res. units	1	1	<1
garages	1		
sheds			
113 Res. units	73	40	16
garages	19		
sheds	19		
barns			
115 Res. units			
garages			
sheds			
Subtotal	113	42	17
12 Commercial			
121 Central Business Dist			
122 Shopping Center/Mall			
124 Neighborhood Business Dist	22	9	4
126 Institutional	1	3	1
Subtotal	23	12	5
13 Industrial			
138 Industrial Park	6	13	5

	# of structures	Area Acres	Hectares
14 Transportation			
141 Air Transportation			
142 Rail Transportation			
143 Water Transportation			
143.1 Private Marina	1	11	4
143.2 Public Boat Landing		1	<1
144 Highways			
145 Communications			
146 Utilities		1	<1
147 Sewage Treatment Plant	3	7	3
148 Landfill			
Subtotal	4	19	8
17 Extractive			
171 Open Pit			
172 Underground			
173 Well			
179 Other Extractive			
Subtotal			
18 Agricultural and Natural			
181 AF Abandoned Field		<1	<1
182 AG Agriculture Active		36	15
183 F Forest		238	97
184 H Heath			
185 OW Open Water		2	1
186 RL Rock Ledge			
187 SL Slump Zone		<1	<1
188 WT Wetland		4	2
Subtotal		281	114
19 Open Land, Other			
191 Outdoor-Public Assembly			
192 Urban Open Lots		1	<1
193 Outdoor Recreation	14	43	18
194 Cemeteries			
Subtotal	14	44	18
Total Acres			411
Total Hectares			167

Shoreline Modifications	Linear Feet	Meters
195 Sea Walls	2347	715
196 Revetments	988	301
197 Groins	# of Groins	2
198 Dock Non-Flow-Through	# of Docks	1

APPENDIX III

Douglas County Data Sheets

Lake Superior Coastal Development Inventory Project:
1992

County Summary Data Sheet

County: Douglas
Coastal Civil Jurisdiction included in summary (in alphabetical order).

Town of Cloverland
Town of Lakeside
City of Superior

LAND USE CATEGORIES

		# of structures	Area Acres	Hectares
11 Residential				
111 Res. units				
garages				
sheds				
112 Res. units		5	1	1
garages				
sheds				
113 Res. units		409	149	60
garages		258		
sheds		76		
barns				
115 Res. units		110	20	8
garages		1		
sheds		45		
	Subtotal	904	170	69
12 Commercial				
121 Central Business Dist				
122 Shopping Center/Mall				
124 Neighborhood Business Dist		22	36	15
126 Institutional		7	10	4
	Subtotal	29	46	19
13 Industrial				
138 Industrial Park		60	150	61

	# of structures	Area Acres	Hectares
14 Transportation			
141 Air Transportation			
142 Rail Transportation	1	56	23
143 Water Transportation	8	53	22
143.1 Private Marina	1	16	7
143.2 Public Boat Landing		4	2
144 Highways		34	14
145 Communications	3	2	1
146 Utilities	9	10	4
147 Sewage Treatment Plant	8	22	9
148 Landfill			
Subtotal	30	197	80
17 Extractive			
171 Open Pit			
172 Underground			
173 Well			
179 Other Extractive			
Subtotal			
18 Agricultural and Natural			
181 AF Abandoned Field		362	147
182 AG Agriculture Active			
183 F Forest		2264	917
184 H Heath		101	41
185 OW Open Water		130	53
186 RL Rock Ledge			
187 SL Slump Zone		192	78
188 WT Wetland		279	113
Subtotal		3327	1348
19 Open Land, Other			
191 Outdoor-Public Assembly			
192 Urban Open Lots		11	5
193 Outdoor Recreation	7	25	10
194 Cemeteries			
Subtotal	7	36	15
		Total Acres	3928
		Total Hectares	1591

Shoreline Modifications	Linear Feet	Meters
195 Sea Walls	19480	5939
196 Revetments	10314	3145
197 Groins	# of Groins 3	
198 Dock Non-Flow-Through	# of Docks 3	

Lake Superior Coastal Development Inventory Project:
1992

Civil Jurisdiction
Summary Data Sheet

County: Douglas
Township, Village or City name: Town of Cloverland
PLSS section data sheets included in summary (give full description):

T49N R10W SEC 1	T49N R11W SEC 13
SEC 2	SEC 14
SEC 3	SEC 22
SEC 8	SEC 23
SEC 9	
SEC 10	
SEC 17	
SEC 18	

LAND USE CATEGORIES

	# of structures	Area Acres	Area Hectares
11 Residential			
111 Res. units			
garages			
sheds			
112 Res. units			
garages			
sheds			
113 Res. units	1	1	<1
garages			
sheds	1		
barns			
115 Res. units			
garages			
sheds			
Subtotal	2	1	<1
12 Commercial			
121 Central Business Dist			
122 Shopping Center/Mall			
124 Neighborhood Business Dist			
126 Institutional			
Subtotal			
13 Industrial			
138 Industrial Park			

	# of structures	Area Acres	Hectares
14 Transportation			
141 Air Transportation			
142 Rail Transportation			
143 Water Transportation			
143.1 Private Marina			
143.2 Public Boat Landing		2	1
144 Highways			
145 Communications			
146 Utilities			
147 Sewage Treatment Plant			
148 Landfill			
Subtotal		2	1
17 Extractive			
171 Open Pit			
172 Underground			
173 Well			
179 Other Extractive			
Subtotal			
18 Agricultural and Natural			
181 AF Abandoned Field		11	4
182 AG Agriculture Active			
183 F Forest		946	383
184 H Heath		1	<1
185 OW Open Water		16	7
186 RL Rock Ledge			
187 SL Slump Zone		75	31
188 WT Wetland		29	12
Subtotal		1078	437
19 Open Land, Other			
191 Outdoor-Public Assembly			
192 Urban Open Lots			
193 Outdoor Recreation	1	1	<1
194 Cemeteries			
Subtotal	1	1	<1
Total Acres		1082	
Total Hectares		438	

Shoreline Modifications	Linear Feet	Meters
195 Sea Walls		
196 Revetments		
197 Groins	# of Groins	
198 Dock Non-Flow-Through	# of Docks	

Lake Superior Coastal Development Inventory Project:
1992

Civil Jurisdiction
Summary Data Sheet

County: Douglas
Township, Village or City name: Town of Lakeside
PLSS section data sheets included in summary (give full description):

T49N R11W SEC 21	T49N R12W SEC 25
SEC 28	SEC 27
SEC 29	SEC 28
SEC 30	SEC 31
	SEC 32
	SEC 33
	SEC 34
	SEC 35
	SEC 36

LAND USE CATEGORIES

	# of structures	Area Acres	Hectares
11 Residential			
111 Res. units			
garages			
sheds			
112 Res. units			
garages			
sheds			
113 Res. units	36	9	4
garages	4		
sheds	5		
barns			
115 Res. units			
garages			
sheds			
Subtotal	45	9	4
12 Commercial			
121 Central Business Dist			
122 Shopping Center/Mall			
124 Neighborhood Business Dist			
126 Institutional			
Subtotal			
13 Industrial			
138 Industrial Park			

	# of structures	Area Acres	Hectares
14 Transportation			
141 Air Transportation			
142 Rail Transportation			
143 Water Transportation			
143.1 Private Marina			
143.2 Public Boat Landing			
144 Highways			
145 Communications			
146 Utilities			
147 Sewage Treatment Plant			
148 Landfill			
Subtotal			
17 Extractive			
171 Open Pit			
172 Underground			
173 Well			
179 Other Extractive			
Subtotal			
18 Agricultural and Natural			
181 AF Abandoned Field		1	<1
182 AG Agriculture Active			
183 F Forest		869	352
184 H Heath		8	3
185 OW Open Water		27	11
186 RL Rock Ledge			
187 SL Slump Zone		114	46
188 WT Wetland		15	6
Subtotal		1034	419
19 Open Land, Other			
191 Outdoor-Public Assembly			
192 Urban Open Lots			
193 Outdoor Recreation			
194 Cemeteries			
Subtotal			
Total Acres		1043	
Total Hectares		422	

Shoreline Modifications	Linear Feet	Meters
195 Sea Walls		
196 Revetments		
197 Groins	# of Groins	
198 Dock Non-Flow-Through	# of Docks 1	

Lake Superior Coastal Development Inventory Project:
1992

Civil Jurisdiction
Summary Data Sheet

County: Douglas
Township, Village or City name: City of Superior
PLSS section data sheets included in summary (give full description):

T49N R13W SEC 19	T49N R14W SEC 10
SEC 27	SEC 11
SEC 28	SEC 13
SEC 29	SEC 14
SEC 30	SEC 24
SEC 32	
SEC 33	
SEC 34	
SEC 35	
SEC 36	

LAND USE CATEGORIES

	# of structures	Area Acres	Area Hectares
11 Residential			
111 Res. units			
garages			
sheds			
112 Res. units	5	1	1
garages			
sheds			
113 Res. units	372	139	56
garages	254		
sheds	70		
barns			
115 Res. units	110	20	8
garages	1		
sheds	45		
Subtotal	857	161	65
12 Commercial			
121 Central Business Dist			
122 Shopping Center/Mall			
124 Neighborhood Business Dist	22	36	15
126 Institutional	7	10	4
Subtotal	29	46	19
13 Industrial			
138 Industrial Park	60	150	61

	# of structures	Area Acres	Hectares
14 Transportation			
141 Air Transportation			
142 Rail Transportation	1	56	23
143 Water Transportation	8	53	22
143.1 Private Marina	1	16	7
143.2 Public Boat Landing		2	1
144 Highways		34	14
145 Communications	3	2	1
146 Utilities	9	10	4
147 Sewage Treatment Plant	8	22	9
148 Landfill			
Subtotal	30	195	79
17 Extractive			
171 Open Pit			
172 Underground			
173 Well			
179 Other Extractive			
Subtotal			
18 Agricultural and Natural			
181 AF Abandoned Field		350	142
182 AG Agriculture Active			
183 F Forest		448	182
184 H Heath		92	37
185 OW Open Water		87	35
186 RL Rock Ledge			
187 SL Slump Zone		3	1
188 WT Wetland		235	95
Subtotal		1215	492
19 Open Land, Other			
191 Outdoor-Public Assembly			
192 Urban Open Lots		11	4
193 Outdoor Recreation	6	25	10
194 Cemeteries			
Subtotal	6	36	14
		Total Acres	1803
		Total Hectares	730

Shoreline Modifications	Linear Feet	Meters
195 Sea Walls	19480	5939
196 Revetments	10314	3145
197 Groins	# of Groins	3
198 Dock Non-Flow-Through	# of Docks	2

APPENDIX IX

Iron County Data Sheets

Lake Superior Coastal Development Inventory Project:
1992

County Summary Data Sheet

County: Iron
Coastal Civil Jurisdiction included in summary (in alphabetical order).

Town of Saxon (Note: Only the town of Saxon lies within Iron County's coastal zone of Lake Superior.)

LAND USE CATEGORIES

	# of structures	Area Acres	Area Hectares
11 Residential			
111 Res. units			
garages			
sheds			
112 Res. units			
garages			
sheds			
113 Res. units	10	6	2
garages	1		
sheds	2		
barns			
115 Res. units			
garages			
sheds			
Subtotal	13	6	2
12 Commercial			
121 Central Business Dist			
122 Shopping Center/Mall			
124 Neighborhood Business Dist		<1	<1
126 Institutional			
Subtotal		<1	<1
13 Industrial			
138 Industrial Park			

	# of structures	Area Acres	Hectares
14 Transportation			
141 Air Transportation			
142 Rail Transportation			
143 Water Transportation			
143.1 Private Marina			
143.2 Public Boat Landing	3	11	5
144 Highways			
145 Communications			
146 Utilities			
147 Sewage Treatment Plant			
148 Landfill			
Subtotal	3	11	5
17 Extractive			
171 Open Pit			
172 Underground			
173 Well			
179 Other Extractive			
Subtotal			
18 Agricultural and Natural			
181 AF Abandoned Field			
182 AG Agriculture Active			
183 F Forest		775	314
184 H Heath		1	<1
185 OW Open Water		4	2
186 RL Rock Ledge			
187 SL Slump Zone		59	24
188 WT Wetland			
Subtotal		839	340
19 Open Land, Other			
191 Outdoor-Public Assembly			
192 Urban Open Lots			
193 Outdoor Recreation		1	<1
194 Cemeteries			
Subtotal		1	<1
Total Acres		857	
Total Hectares		347	

Shoreline Modifications	Linear Feet	Meters
195 Sea Walls		
196 Revetments	979	299
197 Groins	# of Groins 2	
198 Dock Non-Flow-Through	# of Docks	